

IT is a gender thing, or is it?
Gender, curriculum culture and students'
experiences of specialist IT subjects in a New
Zealand High School

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Abbreviations

AAUW	American Association of University Women
CAD	computer assisted design
CD	computer disk
CPS	computer studies
HOD	Head of Department
ERO	Education Review Office
ICT	information and communication technology
IS	information science
IT	information technology
ITAG	Information Technology Advisory Group
KHS	Kahikatea High School
Mac	Macintosh computer
MOE	Ministry of Education
NC	National Certificate
NCBAC	National Certificate in Business Administration and Computing
NCC	National Certificate in Computing
NCEA	National Certificate of Educational Achievement
NZCETA	New Zealand Commerce and Economics Teachers Association
NZQA	New Zealand Qualifications Authority
PC	personal computer
SC	School Certificate
SFC	Sixth Form Certificate

TIM	text and information management
UB	University Bursaries
ob	observation record
sc	student conversation
si	student interview
tc	teacher conversation
ti	teacher interview
v	video

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Abstract

This thesis explores students' experiences of specialist information technology (IT) courses at the secondary school level in New Zealand. It asks whether students experience a gendered curriculum culture in relation to specialist IT subjects. The exploration involves a survey of national curriculum arrangements and detailed consideration of the manner in which the curriculum is implemented in practice by teachers and experienced by students in three case study classes in a conventional high school, Kahikatea High School (KHS). These classes are year 12 computer studies (CPS) and years 12 and 10 text and information management (TIM). Twenty-two students were the focus of detailed observation in the course of a year.

It is found that students experience a gendered IT curriculum culture at KHS, which takes form in both gendered subject and classroom cultures. Gendered subject cultures are established in part through national curriculum structures that maintain subjects from historically gendered domains. Conservative local subject arrangements at KHS contribute to a gendered curriculum in practice. The curriculum takes on a gendered character as a function of choice – teachers' choices about subjects they will offer and the way courses are organised and presented, and students' choices about what subjects they will take. Particular subjects and courses are associated with nominally masculine and feminine computer practices and are thereby imbued with masculine and feminine subject identities.

There is considerable variation and nuance in the way students experience different IT courses and in the meanings they make of their experiences. In short, individual students experience the same course differently. They are influenced to greater and lesser degrees by a range of factors, including expectations, prior experience, classroom pedagogy, classroom relationships and performance. Also, individual students are negotiating their masculine and feminine identities as students of IT and computer users as they participate in specialist IT courses and in other arenas of their lives. As they negotiate their roles as computer users and students of IT at KHS, males and females are established in relations of power or authority with the technology and with each other – as computer controllers, aspirant controllers and competent users. These relationships have a gendered character that derives from the attribution of the

status of controllers to (some) males and the exclusion of females from this group. However, individual males and females aspire to and are attributed the characteristics and status commensurate with a range of user roles. Gender is a factor in individual students' experiences, but in ways that defy stereotyping and that are highly individualised. All this suggests that gender is not essential in the sense that it implies sameness, but also that gender is not *passé* or inconsequential as a factor in students experiences of specialist IT courses. Gender relations are a fundamental and inescapable feature of students' experiences of the IT curriculum in practice at KHS.

Chapter 1 Introduction

This thesis explores high school students' experiences within the context of specialist information technology (IT) courses and classes in a New Zealand secondary school. Information technology is a domain that is often seen as having a highly gendered culture. The focus of this thesis, then, is the intersection between two social phenomena – school computing and gender relations.

Study delineated

From curiosity to research questions

As a child born in the early 1960s and a secondary school teacher in the 1980s and 1990s, I lived through the introduction of computing education in schools, in its various forms. Computers didn't exist in my primary school. They existed but were a mystery during my secondary schooling, the domain of a small group of boys in the computer club. At university in the early 1980s I wrote code for statistical calculations, which was transferred to punch cards. These cards 'disappeared' and someone else fed them to a computer, which magically spat out a paper trail that was my calculations. I saw the results, but never the machine. When I wrote my Masters thesis the computer was a valued assistant. I discovered word processing. In subsequent years the personal computer (PC) became omnipresent in my professional and personal life. During my time as a secondary teacher the drive for computers across the curriculum saw various subjects incorporate computer use and skills development in their teaching programmes, including my teaching area, social sciences. Computer studies was introduced as a subject for national qualifications, initially for Sixth Form Certificate (SFC) at year 12. Specialist IT classes became a common component in schools' subject offerings. There seemed to me to be far greater interest in and uptake of computer related education by girls than had been my secondary schooling experience a decade earlier.

During the same period the policy rhetoric surrounding computer education became that of economic imperative. This is manifested in the international discourse of the “knowledge economy” and “information society.”

New Zealand is rapidly becoming a ‘knowledge society’ with a workforce largely composed of a wide variety of ‘knowledge workers’. These workers have special skills which require updating. So a top quality education system is essential. (Butler, 1996, p.1)

This discourse positions IT education as an engine for the economy, a mechanism for creating prosperity and a panacea for social inequalities (Alton-Lee & Praat, 2000; Clegg, 2001). A computer literate population is assumed to be essential for the economic and social health of nations, including New Zealand.

Greater use of Information Technology in learning in schools is essential if New Zealand is to remain competitive into the next century, and if we are to minimize the growing gap in our society. It can provide a cost-effective learning tool. (Information Technology Advisory Group [ITAG], n.d., p.20)

The discourse of the information society is pervasive and success in life has come to be associated with knowledge about computers.

The Sallis report (Sallis, 1990) articulates two goals. One goal assumes that the use of IT will create more efficient and effective learning. The other promotes access to IT in New Zealand schools as a way of ensuring that students leave school “with the necessary skills to take their place in an information society” (p.3). At a similar time to the production of the Sallis report, Ham (1990) finds that parents identify computers as the thing that their children need to know and understand in order to have a competitive edge in the job market and life in general. Parents may not clearly understand computers or the potential of computers as tools to support their children’s general education, but they think that knowing about computers is important. Knowledge of computers is construed as a new basic of education. Hodson (1990) notes that development of computing in schools occurred in a haphazard manner in the early years. He identifies a shift in focus from provision to pedagogy as educators ponder what it means to use technology appropriately. This is epitomised in the advocacy by some of computers as emancipation agents to support students’ personalized learning, and by others as instruction tools for teachers.

Subsequent New Zealand reports promote the inclusion of IT in schools as a means to enhance learning, promote social equity, prepare citizens for the new knowledge-based economy, and advance the economy based on enhanced IT knowledge and skills (Butler, 1996; Butler & Zwimpfer, 1997). Others investigate the state of IT in schools and levels of use (Atmore, 1995; Harris, 1996; ITAG, 1998; Nightingale & Chamberlain, 1991), strategies and mechanisms for the implementation of IT across the curriculum (ITAG, n.d.; Ministry of Education [MOE], 1998, 2001b, 2002), teacher professional development needs (Gilmore, 1992; Ham, 1999), barriers to the provision and expansion of IT use in schools (Education Review Office [ERO], 1997, 2001; The Learning Centre Trust, 2001), and the effectiveness of IT initiatives (Boyd, 1997, 2002; Harris, n.d; Lai, Pratt, & Trewern, 2001). Reports note that information and communication technology (ICT) is increasingly well provided for in New Zealand schools. According to the Sullivan and Anso report (Sullivan & Anso, 2000), nearly all New Zealand schools have Internet access – 96% of primary schools and 99% of secondary schools. There is an increasing trend for schools, especially large secondary schools, to be networked and the number of computers in schools has increased slightly on 1998 survey results. They note that more is expected of schools. Also, that questions are now asked about what students are doing with ICT, rather than whether they have ICT, as indicators of effectiveness.

The magnitude of ICT developments is linked to an international paradigm shift in education, which can be described as a cultural and educational revolution that has changed the way teachers teach, students learn and schools are organised (Spender, 1998). Kenway (1998) talks of the technologising of education. Pelgrum and Anderson (1999) describe a move away from the older paradigm of education in an industrial society to the rising paradigm of education in an information society. In their view the emerging paradigm has its antecedence in ideas relating to lifelong learning and constructivism. Internationally, educational policy developments are based on the premise that a nation's economic health depend on the success of the information economy and that education needs to take a central role in this economic development (Kenway, 1998; Lewis, Smith, & Jenson, 2001). Developments in New Zealand, then, are consistent with international trends.

In the last two decades, however, concern has been raised in research and populist literature about an apparent gender imbalance in students' participation in specialist computer education or training, at secondary school and tertiary levels, in New Zealand and internationally (American Association of University Women [AAUW] Educational Foundation Commission on Technology, Gender and Teacher Education, 2000; Martin, 2003; Ryba & Selby, 1995). Mathematical applications, such as programming, and gaming are associated with male practice and communications related applications with female practice. This is despite rapid technological change and the emerging position of computers as a ubiquitous feature of daily life for many people (AAUW, 2000; Colley & Comber, 2003; Durndell, Glissov & Siann, 1995). Computers have become increasingly accessible and computer technology has become more user friendly – witness the redundancy of the huge mainframes of twenty years ago that were accessible to a limited number of people and the worldwide expansion in use of PCs, which are now available in many homes and workplaces. The proliferation of Windows software has seen an increasingly friendly computer-user interface. The emergence of the Internet has opened up new information and communication paths for business and private use. This draws into question notions that computers are necessarily a 'male thing', the preserve of male computer geeks, and that they are in some way unfriendly for females. The literature of the 1980s and 1990s, especially that which is preoccupied with computer science and programming domains, may not recognise the changing nature of computer use and any associated change in the nature of computer related schooling. It is therefore appropriate to revisit issues relating to gender, the specialist IT curriculum and students' experiences of that curriculum.

Social and technological developments pertaining to computers arouse my curiosity. Why is it that there appears to be a persistent discrepancy in males' and females' involvement in the IT sector? Is it something about computers and computing, or something about women and men? As a teacher I wonder about the role of schooling. Is there something about the curriculum and the way the curriculum is constructed in practice that puts some students off and turns others on to computers? What are boys' and girls' experiences in IT classes? How relevant is the literature on gender and computers to current practices and experiences of IT schooling in New Zealand? This leads to my research questions, focusing on the culture of computing in

specialist IT classes, as manifested in the curriculum in practice and in males' and females' experiences of that curriculum.

Research questions

Main question:

Do students experience a gendered curriculum culture in specialist IT classes in New Zealand?

Sub-questions:

What is the structure of the formal New Zealand IT curriculum at national and local levels? Is the formal IT curriculum gendered?

How do teachers of the case study classes define specialist IT subjects (CPS and TIM) in practice? Does this contribute to a gendered IT curriculum culture at Kahikatea High School (KHS)?

What are students' experiences of specialist IT subjects (CPS and TIM) in the case study classes? What part does gender play in students' experiences of specialist IT subjects?

Setting the boundaries

The following discussion introduces the key concepts and boundaries of the research questions.

Focus on specialist IT classes

In specialist IT classes, computers constitute both the content and the mode of study. The subject is computers. This contrasts with other subjects which may incorporate computer use in the teaching programme, as a tool or resource to support learning, but where IT is not the primary subject content. The phrase "specialist IT classes" is used in this thesis to encompass the different forms of computing practice associated with a range of traditions, including mathematical computing and office practice.

Computer science is historically associated with mathematical applications, whereas text and information management (TIM) is part of an office practice tradition. Computer studies (CPS) and ICT courses may derive from either or both conventions. These traditions have historical gender connections. In the schooling context there may be considerable overlap and borrowing from the different traditions as the curriculum for school computer courses is worked out in practice, as schools develop and define their subject offerings for students. Some schools may seek to merge courses from the two traditions, and others to keep them separate (see Chapter 4). Specialist IT courses are optional components of the school curriculum. Secondary schools may incorporate IT courses in their compulsory junior school (years 9 and 10) curriculum or include them in the subject options structure. In the senior school (years 11 to 13) students select their subjects for national qualifications. Presumably, then, the students taking specialist IT courses have some sort of interest in computers or in potential computing related employment. There is a suggestion that specialist IT subjects have a gendered character, based on the traditions from which they derive and on stereotypical notions that different computing practices are favoured by boys and girls. Mathematical computing, including programming, is associated with male computer practice, whereas office practice applications, such as word processing, are associated with female practice (see Chapter 2). Specialist IT classes therefore provide a pertinent setting in which to investigate the culture of curriculum and students' experiences of different types of computing practice and to question the aptness of gender stereotypes in a time of rapid technological change.

The nomenclature in the literature relating to IT schooling is sometimes confusing. In the international literature the term "computing" often reflects a mathematical conceptualisation of IT, meaning to compute. As IT uses have expanded, however, the word computing has become an umbrella term for a range of IT practices, the meaning of which has become increasingly equivocal. Mitra, Lenzmeier, Steffensmeier, Avon, Qu and Hazen (2000) are of the opinion that computing is a fuzzy term and that there is often no attempt in literature to distinguish between types of computing practice. Others (Loveless, DeVogd, & Bohlin, 2001; Todd, 2000) distinguish between the ability to use software applications and the ability to question, interpret, analyse and communicate meaning from information, which they label IT capability or IT literacy. I use the terms IT use, IT practices, computing and computer

practices interchangeably to refer to a range of computer uses. Where I wish to distinguish between uses I identify particular types of software applications or add a descriptor, for example, mathematical computing or communication uses.

Two variants of the specialist IT curriculum, CPS and TIM, comprise the subjects and specific courses that are the core of the empirical research reported in this thesis. The case study classes are located within one school, KHS. This study focuses on three classes because they provide clearly definable settings where the development of computer knowledge and skills are the primary function of the curriculum, at different year levels and in different subjects. At the time of data collection the introduction of the National Certificate of Educational Achievement (NCEA) qualification was imminent and the teachers at KHS were contemplating the framework they would adopt for their specialist IT courses and assessment. There was no suggestion of merging the two curriculum traditions. Rather, discussion focused on ways of preserving the individual identities of the two courses that were the traditional curriculum offering at KHS (see Chapter 5).

Focus on curriculum in practice

The curriculum of students' classroom experiences is a curriculum of practice. It is an enacted curriculum, which is constituted by action, interaction and negotiation in the classroom. The enacted curriculum is what actually happens rather than what is written in curriculum documents for particular subjects. It is located in classrooms rather than in national policy. This is an experiential and interpretive notion of curriculum. However, this concept of curriculum does not ignore official, national curriculum arrangements and structures, presenting these as significant contextual features.

McGee and Fraser (2001) describe an "operational curriculum" (p.88), which results as teachers follow through on plans and put them into action in the classroom. Bruner (1996) argues that there is no such things as *the* curriculum, and describes curriculum as "the means of aiding and abetting the learner" (p.115) and as an "animated conversation" (p.116) that involves the use of teaching tools such as props, pictures and demonstrations. Teachers can be seen as curriculum agents. They make decisions about what is taught, in what order, and in what way.

Teachers don't merely deliver the curriculum. They develop, define it and reinterpret it too. It is what teachers think, what teachers believe and what teachers do at the level of the classroom that ultimately shapes the kind of learning that young people get. (Hargreaves, 1994, p.ix)

What these theorists have in common is the idea that the curriculum exists in practice and is integrally linked to the pedagogy of classrooms.

Curriculum is also an ideological force. To use the words of Giroux (1997), schools are not “ideologically innocent” (p.133). The process of curriculum negotiation is complex, as schools and teachers act to reproduce and challenge dominant social relations and interests. According to Goodson (1988), curriculum is created in the collision of current practice and a historical inheritance of formal curriculum documents and previous practice. This may result in apparent contradictions or aberrations in relation to the official curriculum. He describes the secondary school curriculum as “highly contested, fragmented and endlessly shifting terrain” (Goodson, 1998, p.231). It is socially and politically constructed by players in pursuit of individual and collective ends. Cornbleth (1990) talks of curriculum as “contextualized social process” (p.25) that encompasses both content and classroom practice. She thinks of curriculum as that which actually occurs in the classroom, but stresses that this cannot be understood or changed without understanding the context within which curriculum is shaped. This context is structural and socio-cultural. The structural context incorporates "established roles and relationships, including operating procedures, shared beliefs, and norms" and the socio-cultural context is the environment beyond the education system and structural context, including "demographic, social, political, and economic conditions, traditions and ideologies, and events that actually or potentially influence curriculum" (p.6).

Others talk of a hidden curriculum that exists in the daily interactions and patterns of school life, which contrasts with a written or formal curriculum (Apple, 1999; McGee & Fraser, 2001). McGee and Fraser (2001) describe the hidden curriculum as “all the things children learn at school alongside the official curriculum” (p.89), which relate to overt and covert rules, routines and regulations that children learn to live by at school, in the process of which they learn both positive and negative things about school and about life. Teachers may be oblivious to some of these social structures. The hidden curriculum constitutes things that are taken for granted in schooling practices, which includes a wide range of ideological and marginalizing

schooling dimensions, including gender (Bryson & de Castell, 1998; Jones, 1988). The hidden curriculum helps to initiate students into particular gender relationships and roles, such as potentially constructing males as more authoritative and females as more passive figures. The hidden curriculum exists in school curriculum structures and in pedagogical practices and interactions in classrooms.

The national qualifications guidelines and prescription documents for specialist IT courses provide structural and content boundaries for the presentation of IT courses in New Zealand secondary schools. However, the classroom is the site where the IT curriculum is presented by teachers in practice and experienced by students. Students can also be seen to play a role in the formulation of the IT curriculum in practice, albeit to greater or lesser degrees in different classrooms.

...the construction of activities and of expertise in a school classroom is a joint undertaking by the participants. The students' developing knowledge and expertise is built on a framework of activities and settings (including the use of technology), within which they interact with others who guide and channel their development... Teachers select and arrange activities to meet their pedagogical goals... However, within these activities and settings students actively take and create opportunities for their own learning. They have goals, beliefs, and experiences to draw on too. The ideas and actions of both teacher and student influence each other in complex ways. (Parr, 1999, p.366)

What happens in IT classrooms thus defines the curriculum in practice, although this is shaped and regulated by national policy and formal curriculum documents.

Focus on curriculum culture

The notion of a curriculum in practice suggests that there is a culture to curriculum. That is, that curriculum incorporates and sustains values and ideas about what are appropriate things to know and do in particular subjects, including the variety of subjects that comprise the IT curriculum. These values may be reflected both in formal curriculum arrangements, such as subject prescriptions, content guidelines and teaching programmes, and in the activity and pedagogy of the classroom. Curriculum culture thus encapsulates a range of contributing subject cultures.

Subject culture transcends school boundaries and describes the values and traditions of particular subjects, which derive from the character of the subject matter and from the social

and political processes that have formed the subjects or disciplines to which they relate (Goodson, 1998). Curricula for different subjects have histories and particular cultures, or subcultures, which are reinforced by generations of teachers in their practice. Thus, subject culture relates to pedagogy, to the teaching practices that are generally accepted as the way that the content of a subject could and should be presented and organised.

When we refer to 'subject area subcultures', then, we mean the general set of institutionalised practices and expectations which has grown up around a particular school subject, and which shapes the definition of that subject as both a distinct area of study and as a social construct. The subject subculture exists previous to classroom realization (as well as in its expression within that realization)... For instance, art students may be expected to have a different set of priorities, a different set of classroom activities, and a different way of relating to both their class work and their teacher from students in a history class. (Goodson & Mangan, 1995, p.615)

Goodson and Mangan (1995) argue that subject subcultures are durable, but they are not immutable; rather, "they are sites of continuous contestation, and ongoing processes of redefinition, even as they are reproduced" (p.615). This contestation may take place within and between classroom teachers and curriculum developers operating at school and national levels. Although subject culture transcends school boundaries, it does not exist or develop external to school settings. Schools can be viewed as sites of subject culture development, given the enacted nature of the curriculum in practice.

The idea of subject culture is intertwined with the notions of subject identity. Some talk of subject identity as subjectivity (Hollway, 1984) and of subjects as subjectivities (Davies, Whitehouse, & Gilbert, n.d.) as ways of describing subjects as socially constructed phenomena. These concepts invite consideration of what a subject is and does, what constitutes appropriate or valued content matter and modes of learning about that content, and what it means to be a good student or an effective teacher of that subject. Subject culture imbues different subjects with different identities. Subject identities provide a lens on subject culture.

The culture of the classroom is defined by pedagogic practices and associated classroom interactions and relationships (Goodson & Mangan, 1995). For example, classes may be described as having a competitive culture or a student-centred culture. Classroom culture and subject culture are linked. Classroom culture reflects ideas about what should be taught and how it should be taught, as well as contributing to the development of beliefs about what

learning in a subject entails. There is a theoretical association between pedagogic practice and classroom relationships, each influencing the other in the development of classroom culture. Changes in pedagogic practices, such as the introduction of inquiry strategies, facilitation modes of teaching or the use of computers, may be seen to stimulate change in the way participants interact in the classroom. Conversely, the relationships that exist between teacher and students may be viewed as an important factor influencing the success or otherwise of pedagogic reforms. In a sense, then, classroom culture is comprised of pedagogical practice and classroom interaction, which has a bearing on the subject culture that develops in a local setting and may sustain or challenge broader subject cultures.

In reporting the findings of the Curriculum and Context in the Use of Computers for Classroom Learning project, Goodson and Mangan (1995) find that when computers are introduced in different classes, in the context of cross-curricula computer initiatives, pedagogical practices and classroom interactions are altered, contingent on the pattern of computer installation. The use of computers appears to necessitate individualised and small group activity and to inspire a reduction in instructional and whole class discussion time. Classroom culture changes, albeit more so in some subjects than others, depending on the existing classroom culture and antecedent subject cultures. They argue that computers are more readily adopted as a feature of classroom practice when their use precipitates little change in existing content or pedagogy, and that teachers make the use of computers in classes compatible with different subject cultures by viewing computers as tools that can and should be used differently in different subjects. Schofield (1995) similarly describes resistance to the use of computers in classrooms by teachers who do not believe that computers will add anything to their current classroom practice and have little bearing on their goals, or who see them as a disruption to the classroom's traditional social organisation. This could also be seen as a tension deriving from a clash of subject cultures, between those that give pre-eminence to academic learning and those relating to vocational or technical learning. This tension is negotiated at a classroom level.

What are the implications of this conceptualisation of curriculum culture for this study?

Firstly, specialist IT subjects can be conceived as having particular subject cultures or embodying ideas about what learning in a subject entails, which are negotiated in practice and

exposed in the pedagogy and the nature of classroom computing activity. Secondly, different specialist IT subjects, from different curriculum traditions, may be thought of as having distinctive subject cultures. These give different IT subjects unique identities. The curriculum culture pertaining to the specialist IT domain at KHS is thus an amalgam of different subject cultures, located in the situated practice of particular classes but with a history and tradition associated with particular subjects.

Focus on student experience

Experience is a nebulous concept. It is a word often used in educational research literature, but rarely defined. Yet it is a concept central to social science research, which is concerned with humans and their relations with themselves and their environments (Clandinin & Connelly, 1998).

The word *experience* is found in homes, schools, higher education, and adult learning institutions. It is found in the most practical discussions of education, and it is found in the most revered theoretical texts. It is owned by no subject field and is found in virtually any community of educational discourse... It is mostly used with no special meaning and functions as the ultimate explanatory context: Why do teachers, students, and others do what they do? Because of their experience. (Clandinin & Connelly, 1998, p.152)

To experience something is to go through some sort of process, to undergo some sort of transformation. To be experienced is to know or understand something, to make meaning of what one does and observes. That knowledge may be shared by others or be a uniquely personal understanding. One person's experience of the same event can be quite different to another's. Describing others' lives or experiences is problematic. Experience is intensely personal and only fully knowable to the person having the experience, as elucidated in the following literary excerpt.

What a wee little part of a persons life are his acts and his words! His real life is led in his head and is known to none but himself. All day long, and every day, the mill of his brain is grinding, and his thoughts, not those other things, are his history. His acts and his words are merely the visible, thin crust of his world... The mass of him is hidden – it and its volcanic fires that toss and boil, and never rest, night nor day. These are his life and they are not written and cannot be written.

(Clara Clemens, daughter of Mark Twain, 1947; introduction to *Mark Twain at Your Fingertips*, www.twainquotes.com/Twain.html accessed 4/9/03)

A person cannot get inside other people's minds. The best that can be done is to look for clues about people's experiences in their language and/or actions.

A range of social factors affect students' schooling experiences. Nuthall and Alton-Lee (Nuthall, 1999; Nuthall & Alton-Lee, 1993) argue that students participate in different cultures or social arrangements inside and outside the classroom, which exposes them to various and potentially conflicting ideas on how to process their experiences and ascertain the relevance of information or activities. Gender features as a factor that influences how students experience the curriculum in practice and how they learn, through processes of inclusion or exclusion from cognitive and social processes in the classroom (Alton-Lee, Densum, & Nuthall, 1990; Alton-Lee & Nuthall, 1990; Alton-Lee & Nuthall, 1991). Kimmel (2000) makes a connection between experience, schooling and gender:

On the one hand, we sit in the same classroom, read the same books, listen to the same teachers, and are supposedly graded by the same criteria.

But are we having the same experience in those classes? Not exactly. Our gendering experiences begin even before we get to school... We learn, and teach one another, what it means to be men and women. And we see it all around us in our schools, who teaches us, what they teach us, how they teach us, and how the schools are organized as institutions... Both in the official curriculum – textbooks and the like – and in the parallel, “hidden curriculum” of our informal interactions with both teachers and other students, we become gendered. (Kimmel, 2000, p.151)

He suggests that students learn that males and females are different, from the content and form of education they experience at school; they learn that gender inequality is justified because it stems from apparently natural or normal difference. He argues that observable gender differences are the product, not the cause, of gender inequality and that what is taught and tolerated at school reinforces inequalities. Gender difference and gender inequality are features of students' schooling experiences.

Translating these ideas to the context of specialist IT schooling, it can be argued that boys and girls develop ideas about the importance or relevance of computers in their lives and what it means to be male or female in their experiences of the IT curriculum in practice. This gives meaning to their interactions with computers. Classrooms aren't the only arenas within which these ideas are formulated but they are sites of structured, observable IT learning experiences. I define students' experience of IT classes as both the activity in which they engage with computers and the meaning that is made of this activity; that is, the physical and verbal interactions that take place, the way this activity is interpreted and the attitudes that develop.

Focus on gender

Gender – the social construction of sex – is a fundamental aspect of social relations (Connell, 2002b; Fenstermaker & West, 2002; Kimmel, 2000; Knuttila, 1996).

Since every interaction involves a male or a female, sex is everywhere; we must take it into account... But being male or female carries few meanings in and of itself; its most potent meanings come from the social and cultural meanings attributed to it. These meanings we call gender, the social construction of sex. (Biklen & Pollard, 1993, p.1)

How gender relations are organised, how “women and girls, men and boys are categorized, expected to behave, do behave, and are treated”, is one of the most important influences on human behaviour and interactions (Knuttila, 1996, p.173). It defines social relations – power, authority, responsibility; work and production; emotional and personal relations. Daily social interactions reflect and contribute to the maintenance or modification of gender differences, producing and reproducing gender identity (Hollway, 1984). The processes that position males and females in different roles, relationships and discourses help to define the desires, perceived needs or aspirations of individuals (Henriques, Hollway, Urwin, Venn, & Walkerdine, 1984). Adopting the notion of gender as a social construction means accepting that gender is a pervasive factor in social interactions, albeit of differing significance or intensity in any particular situation.

To understand gender it is necessary to make comparisons and appreciate gender differences.

How they [men and women, boys and girls] act, both with each other and across sex boundaries, is constructed not only culturally but also by gender. Gender as a category of analysis, suggests that to understand female - or male - experience each must be analyzed in relationship to the other in order to see how each is shaped by the other. (Biklen & Pollard, 1993, p.1)

However, recent social constructionist views of gender challenge perspectives that focus on gender as a matter of individual sex-role differentiation and on the dichotomy between male and female. They challenge ideas that differences within gender groups are aberrations on the norm. Kimmel (2000), for example, argues for a concept of gender as plural, encompassing masculinities and femininities, and as relational and situational.

...because gender is plural and relational, it is also situational. What it means to be a man or a woman varies in different contexts. Those different institutional contexts demand and produce different forms of masculinity and femininity. “Boys may be boys,” cleverly comments feminist legal theorist Deborah Rhode, “but they express that identity differently in fraternity parties than in job interviews with a female manager.” Gender is thus not a property of individuals, some “thing”

one has, but a specific set of behaviors that are produced in specific social situations. And thus gender changes as the situation changes. (Kimmel, 2000, p.90)

He also argues that gender is as much a property of institutions as it is a part of individual identities, that “gendered individuals interact with other gendered individuals in gendered institutions” (p.95) and that “not only do gendered individuals negotiate their identities within gendered institutions, but also those institutions produce the very differences we assume are the properties of individuals” (p.96). Connell (2002a, 2002b) similarly argues that there is no single form of masculinity or femininity in western societies. Rather, there are different ways of being male and female. He challenges the stereotypes that categorise males and females as singular groups, such as notions that males are dominant and competitive and that females are passive and caring. However, he talks of culturally dominant forms of gendered being, which create the gender order or gender arrangements of contemporary society. He identifies “hegemonic masculinity” and “emphasised femininity” as dominant forces in gender politics (Connell, 2002a, p.61). These are gender constructs to which males and females are expected to conform, whether or not they feel like it. Particular forms of masculinity and femininity thus have ascendancy in everyday life, although these are contested and contestable (Connell, 2002a, 2002b). Connell argues for a focus on gender relations, rather than on gender *per se*. Focusing on gender relations highlights differences both between and within gender groups. Attention is paid to differences among men and among women and to the shared capacities of males and females; that is, the ways that males and females are both divided and connected. The concept of gender relations allows gender to be defined differently and in contradictory ways in different social contexts (Connell, 2002b).

Gender is one of several pervasive social constructions. Post-positivist feminist perspectives emphasise the intersection with class, ethnicity and sexuality discourses in the construction of gender identities and gender relations (Bensimon & Marshall, 1997; Harding, 1987; Kenway, Willis, Blackmore, & Rennie, 1994; Middleton, 1993; Stepulevage, 2001; West & Fenstermaker, 2002; Wolfe, 2000; Yates, 1997). Jones (1988), for example, argues for perspectives that see women/girls as non-unitary groups. She argues that race and class may be very powerful constructs for some groups of women/girls and that knowledge is differentially distributed on the basis of race and class to different groups of girls in the classroom. This means that girls as members of race and class groups may receive quite

different knowledge about learning and teaching and about their abilities. Presumably the same could be said of different groups of men/boys. Mac an Ghail and Haywood (1998) advocate for a concept of gender as a dynamic process. They are critical of educationalists who view gender as nothing more than a technical variable and of a tendency to see gender relationships in binary terms and masculinity and femininity as unitary and complimentary constructs. They emphasise the importance of context, such as peer group cultures, changing family forms and changing labour markets in the emergence of new masculinities and femininities. Gilbert (2001) is similarly critical of views of gender that assume an essential biological reality or generalise about gender in a way that obscures the variation that constitutes different females' and males' experiences and the breath of gendered identities. She argues for gender as a "discursive construct, as something which functions symbolically, at the level of our collective unconscious, to structure our social order" (p.295).

Another way of conceptualising gender and gender identity is in the idea possible selves. According to Markus and Nurius (1986), possible selves "represent individuals' ideas of what they might become, what they would like to become, and what they are afraid of becoming" (p.954). The possibilities are individually attributed, but socially defined.

I am *now* a psychologist, but I could be a restaurant owner, a marathon runner, a journalist, or the parent of a handicapped child. These possible selves are individualized or personalized, but they are also distinctly social. Many of these possible selves are the direct result of previous social comparisons in which the individual's own thoughts, feelings, characteristics, and behaviors have been contrasted to those of salient others. What others are now, I could become. (Markus & Nurius, 1986, p.954)

Possible selves are also gendered selves.

...when adolescents are considering their future selves, girls and boys have different cognitions about most probable and most promising selves which may affect their future career aspirations. (Curry, Trew, Turner, & Hunter, 1994, p.136)

Possible selves are changeable. There is a link between possible selves and decision-making, possible selves and motivation, possible selves and cognition or the ways people come to understand and interpret the world. Curry et al. (1994) draw on the concept of possible selves to explain females' under-representation in occupational fields such as science and technology. They argue that women and girls tend to place themselves within particular life domains that influence the choices they make about the kinds of lives they want to live.

Individual females adopt a careerist, adaptive or home-centred orientation, which defines their notions of what they could be and ideas about what they want to do in their lives. In contrast, boys comprise a more homogenous group with careerist aspirations.

The concept of possible selves implies multiple masculinities and femininities, that males and females could potentially adopt various identities and roles. In terms of IT education, different boys and girls might hold different concepts of possible IT selves in relation to their life and career aspirations. These concepts of self might require different computer skills and knowledge. Consequently, they would be likely to orient themselves towards the forms of computer schooling that they think would best prepare them for their anticipated roles and respond differently to the experienced curriculum. Their notions of self, as users and students of IT, might conform to or challenge gender stereotypes pertaining to computer use and interests.

Mine is a social constructionist conception of gender that acknowledges a variety of gender identities – femininities and masculinities – and the situated nature of gender construction. I do not assume gender to be the only influence or necessarily the main influence on students' experiences in specialist IT classes in particular situations. Nor do I assume males and females must necessarily be different, or all males and all females the same. However, my work is based on the precept that gender relations are fundamental social structures and are pervasive influences in students' classroom experiences. Also, that gender relations operate in specialist IT classrooms in New Zealand secondary schools, as in all other sites of human interaction. This is supported by literature that suggests that a lack of participation of women and girls in the IT sector derives in part from girls' schooling experiences with computers and that gender is a persistent factor influencing peoples' experiences of computers at school (see Chapter 2).

The debate in the literature relating to males' and females' school computer experiences does not necessarily justify another study relating to gender and IT schooling. My intention, though, is to look at an aspect of IT schooling that has received scant attention – the intersection of different specialist IT traditions. In New Zealand, different specialist IT subjects from gendered traditions are contesting and appropriating a range of applications as the legitimate learning content of those subjects. My aim is to investigate students' experiences of different

types of specialist IT subjects and the negotiation of gender relations in the context of the IT curriculum in practice.

Rather than focus solely on adolescent females in this research, I consider broader concepts of gender and gender relations. This is because perceived problems relating to females and their computer uses and preferences become issues when contrasted with males' computer activities (see Chapter 2). It is the relativity, the relationship between the genders, which is the heart of the issue. Also, there is a dialectic relationship between gender and experience. As gender affects a person's experience, so does a person's experience affect the construction of his or her gender identity. Discussion about the role of gender in students' experiences of the IT curriculum in practice is predicated on the view that everyday male-female interactions help to structure the schooling experiences of students, while at the same time being defined by those experiences. This research does not claim gender to be the only social construction that plays a part in students' experiences. Other factors, such as ethnicity and class, will be considered if and as they emerge from the data and within the limits of the empirical information available.

When asking whether students experience a gendered computer culture in specialist IT classes in New Zealand, one is asking whether there is something about the nature of the subjects that assumes differences in gender roles or interests and promotes different forms of computer learning for males and females. Is there something in formal and nationally sanctioned curriculum arrangements, historical curriculum patterns and in the way the curriculum is constructed in practice at school level that enshrines gender differences? Do the pedagogical practices, interactions and relationships formed around computers, which students experience in specific IT courses, establish or maintain notions of gender differences in computer ability, roles or interests?

Chapter 2 Gender, IT and schooling

This chapter presents a review of literature relating to gender and information technology (IT) schooling in New Zealand and internationally. The international literature relating to the secondary school level is canvassed. Literature pertaining to the primary and tertiary sectors is also utilised in the exploration and elucidation of the emerging themes.

Theorising gender and IT

Three main conceptions of IT are discernable in the historical literature theorising computer technology and gender: the first is computers as artefacts; the second is computing as a subject or discipline; and the third is computing as culture. Wajcman (1991) identifies three distinct perspectives on technology. These are: computer technology as hardware or inanimate physical objects; computing as technocratic knowledge captured in various disciplines, such as engineering, which provides the know-how to create, repair and use computers; and computing as human activities and practices, or what people do with the technology. The first two of these perspectives tend to assume that technology is value free and socially neutral. The third reflects a social constructionist view of computing as culture, where computers are seen as value laden tools that result from and influence social interactions.

Early feminist theorists challenge ideas of the rational and a-social computer. They display interest in the social and affective character of IT. For example, Turkle (1984) promotes the idea of the subjective computer as the antithesis of the instrumental computer. The subjective computer is part of people's social being, affects the way people think and conjures up emotional responses. She argues that computers enter into the development of personality, identity and sexuality. This is different to the computer that is constrained by logic and uniformity.

The social constructionist discourse has become prominent in discussion relating to gender and computers in recent decades. It is the basis of much feminist theorising on the subject.

Computer technology, in both design/form and practice/use, is seen to embody and influence gender relations.

Theoretically, I view both technology and gender as social and cultural constructions. Technology does not exist in a vacuum; it exists only in social contexts, and as such exists in a gendered world. Similarly, gender is assumed to be constructed within a culture and not genetically inherent in an individual; gender is not something we are, but something we do. (Christie, 1997, fulltext, ¶ 9)

It is argued that gender is a key dynamic in understanding the present educational meanings of computing (Clegg, 2001). Social practices are seen to institutionalise power and computer expertise with males.

An anti-essentialist discourse of gender has also emerged. The idea that the apparent absence of women from the technological domain is attributable to essential differences in the ways that women and men think and relate to the world is rejected, as is the assumption that all women's (and all men's) experiences are broadly similar. Similarly, the attribution of computing technology with innate masculinity is questioned. Also challenged are ideas that solutions to gender inequities lie in the development of alternative feminine technology and that solving inequalities in computer use is a matter of greater deployment of existing forms of supposedly gender-free technology (Adam, 1998; Gill & Grint, 1995). Grint and Woolgar (1995) take an anti-essentialist position in asserting that the gender of a technology is a temporary feature of the ongoing interpretation by designers, sellers and users – “the politics and values of technology, in this perspective, result from the gaze of the human; they do not lie in the gauze of the machine” (p.70).

There are conflicting discourses surrounding gender and IT. For some, IT is a value free and socially neutral tool or technique. In effect, gender is irrelevant. For others, IT is a socially constructed and gendered technology. This is one of the fundamental distinctions in ways of conceptualising IT. Another distinction comes in the division between those who tend to essentialise IT and gender, and those who take an anti-essentialist position. For the former group, different forms of IT are seen as inherently masculine or feminine and males and females may be thought to naturally prefer and dominate particular IT practices. In contrast, anti-essentialists would argue that social constructions of IT and gender are fluid. Computer technology is subject to change and the social constructions of IT both reflect and influence the values and prominent discourses in particular historical contexts. Males and females are

seen to constitute heterogeneous groups. Gender is seen to be flexible, subject to redefinition and multiple definitions as gender roles are negotiated. Thus both gender and IT are problematic.

Discourses of gender and IT schooling

Much of the research of the 1980s and 1990s pertaining to gender and schooling in IT fits within what I label an equity discourse. The focus of the literature is the apparent gender imbalance in computer access and types of use, the prevalence of gendered domains of IT practice and male computer culture, and apparent social and economic advantage and disadvantage accruing as a result of this imbalance. More recently, a critical discourse has emerged, which questions assumptions of female disadvantage and school computing as a male culture. Attention is focused on the heterogeneous nature of females' and males' experiences of IT, gender-technology relations and gender identity formation.

Gender equity discourse

Matters relating to computer access, preferences and culture are discussed separately in this section, but they should be viewed as intertwined phenomena that contribute to a gender equity discourse pertaining to IT schooling. Some of the research reported makes a clear distinction between school and out-of-school uses, and some doesn't, hence the mixture of more general and schooling specific examples of IT practice.

Access and usage

In the international literature of the 1980s and early 1990s concern is expressed that girls suffer from lower levels of access to computer technology and participation in computer related courses relative to boys. This concern emerged when computers were something of a novelty and when computer education tended to reside in computer science classes.

In early research literature, boys are reported to use computers more often than girls at school and at home, to dominate the technology and commandeer the most up to date computers in

classroom settings, to have higher participation rates in specialist computing classes and computer clubs, and to have greater experience of particular activities, including programming and gaming (Beynon, 1993a; Culley, 1986, 1993; Edmonds, 1988; Hoyles, 1988; Kramer & Lehman, 1990). Based on research in San Francisco Bay Area high schools, Chen (1986) finds that adolescent boys are more likely to have taken computer programming courses before and during their high school years, that computers are more commonly found in boys' homes and that boys are more likely to use computers at home. Similarly, Becker and Sterling (1987) find that United States teachers report substantial male dominance in school computing, particularly in before and after school activities, in elective programming activities in elementary schools, and in game-playing in middle and high schools. Boys are reported to dominate time on computers at all levels of schooling, except word processing at high school. Word processing is the only aspect where girls are reported to dominate in the computer use statistics.

Such findings are also supported in more recent European studies. In their work relating to IT use in Scottish schools Durndell, Glissov and Siann (1995) find persisting gender differences. Boys are found to make more overall use of computers than girls, both inside and outside of school. Exceptions to this relate to the use of computers at school for playing games, where no significant differences were found between boys and girls, and to the use of computers for word processing outside of school, where likewise no significant gender differences are reported. Colley and Comber (2003) compare the results of their questionnaire survey of hundreds of students aged 11-12 and 15-16 years from schools in the English Midlands with an earlier study and note that boys still use computers more than girls, especially for game-playing. In a study of personal narratives of tertiary students, Clegg and Trayhurn (2000) reveal gender differences in current and previous levels of computing access and use, with males having greater access to computers at home and wider experience of computer gaming and programming, as well as dominating computer use at school.

Examples in a sparse New Zealand literature present similar findings of gender difference in historical levels of participation and access to computer technology. Vasil, Hesketh and Podd (1987) report that significantly more males than females had greater access to computers in the 1980s and that boys were more frequent users of computers. These differences are attributed

to gender. Girls in single-sex schools had less frequent access to and made less frequent use of computers than did boys in single-sex schools. However, there are no significant observed differences between girls in single-sex and co-educational schools. In their examination of the attitudes and experiences of a group of students in the Freyberg project, an integrated IT curriculum innovation, McKinnon and Nolan (1990) find that boys have significantly greater access to computers at home than do girls across all socio-economic levels. Girls in the study spend significantly less time using computers, which is attributed primarily to males' higher levels of home computer use. Persistent differences in access and usage are noted in later studies. In particular, there are reported tendencies for boys to have greater access to home computers and to dominate computers in primary and intermediate school environments, controlling and claiming the most time with computers. This effectively restricts access to the technology for girls (Alton-Lee & Praat, 2000; Crooks & Flockton, 1996; Haisman, 2001).

Differential access and male domination of computers in schools is attributed in part to historical institutional policies and practices for resource use and allocation. Some maintain that policies in co-educational secondary schools, which locate computers in mathematics or computer departments, ensure that girls are more likely to miss out on experiences with computers than are boys. It is argued that traditionally girls have less positive attitudes towards mathematics and science subjects and that locating computers in these areas and associating computer use with these subjects is less likely to encourage computer use among girls than it is among boys (Beynon & Mackay, 1993; Culley, 1993; Newton & Beck, 1993). Crawford, Groundwater-Smith and Millan (1990) find unequal patterns and male domination of computer use in New South Wales secondary schools, especially when computers are made available to students outside of assigned class time and there is competition for use of computers located in computer rooms. Elliott (1991) describes a situation of historically protected access to computers in New Zealand secondary schools and suggests that confining computers to specialist rooms contributes to gender inequities in computer use.

Responsibility for gender difference in computer access is also attributed in part to the interests and actions of individual teachers. The ImpacT Report (Watson, 1993) investigates the use of computers in four foundation subjects – English, mathematics, science and geography – in a large number of English secondary schools. It concludes that there is

considerable variation and inequity in the level of access between pupils in the same class, between different classes and between different age groups, which is dependent partly on the interests of individual teachers. Access is limited by organisational constraints in secondary schools and influenced by the interests of particular teachers or departments. Others find that pedagogical practices that leave students to learn by themselves are particularly problematic for girls. In such situations boys are more likely to be able to draw on prior experience and girls are penalised for a comparative lack of access and lower use of computers at home, a situation that is compounded by patterns of computer use in the classroom (Alton-Lee & Praat, 2000; McKinnon & Nolan, 1990). Teachers may be oblivious to gender differences and issues relating to computer access. Crawford et al. (1990) observe that the majority of computer coordinators they surveyed think that there are no gender inequalities in access, but that there is a mismatch between computer coordinators' and students' views of computer access and that teachers' perceptions are contradicted by other sources.

General levels of access to computers in the western world, for males and females, have improved. Nevertheless, recent literature highlights persistent gender inequalities relating to computer access and participation as a function of socio-economic status and home situations. In particular, students from lower socio-economic circumstances and cultural minorities continue to be excluded from engagement with computers, and girls tend to be excluded to a greater degree than their male peers (Butler, 2000; Hackbarth, 2002; Millard, 1997). This is portrayed as an equity issue.

Gendered preferences

Associated with the talk about gender differences and inequities in access to computer technology is concern about males' and females' reported attitudinal differences or preferences for different types of computing practices. Attitudes tend to be reported as likes and dislikes, judgements on the worth or value of computers, expressions of self-efficacy or confidence with computers, and affective responses or indicators of anxiety. An equity problem is perceived in a tendency for girls to dislike and be less familiar with some forms of computing, particularly those that have traditionally counted in the disciplines of academe and in the IT industry.

The international and New Zealand literature of the last few decades relating to students' attitudes to computers is varied and sometimes contradictory. However, males and females are reported to prefer different types of computer applications (for example, Becker & Sterling, 1987; Vasil et al., 1987). In his seminal early work on gender and students' schooling experiences, Chen (1986) finds that girls prefer different types of computing activities and engage with computers in different contexts to boys. He reports no significant differences in computer use in courses like business and vocational options, which offer non-programming applications such as drill-and-practice and word processing. In the New Zealand context, McKinnon and Nolan (1990) report that girls express preferences for word processing activities, including use of typing tutor software, and the boys for using utilities, graphics and drawing programs and games. In their opinion, males exhibit more stereotypical preferences in their engagement with computers.

Women and girls are commonly identified as having less positive attitudes towards computers than do men and boys (De Jong, 1994; Jackson, Ervin, Gardner, & Schmitt, 2001; Kramer & Lehman, 1990; Mitra, LaFrance, & McCullough, 2001). Girls are portrayed as less confident computer users, more tentative, anxious or afraid of computer technology, and as having lower levels of self-efficacy relating to computer technology, particularly in relation to practices associated with computer science, such as programming (Applebee, 1994; Chen, 1986; Colley & Comber, 2003; Crawford et.al., 1990; Opie, 1998). They are also observed to be more cautious in their assessments of the value of technological innovations (Chambers & Clarke, 1987; Crombie & Armstrong, 1999). In his work with year 9 and 10 students engaged in LOGO programming, Beynon (1993a) finds that the girls are much more critical and less accepting of the possible benefits of micro-technology than the boys, which is not to say that the girls are universally critical or that all the boys are enthusiastic about computers and computing. High achievers are more likely to be supportive of computing activities than low achievers, and boys are most likely to be computer advocates than girls, even the low achieving boys. Girls tend to be critical of the amount of time they have to use computers, which they see as taking away from other classroom activities, and willing to question the utility of a computer compared with other information sources and modes of processing information. Gender differences in attitudes and preferences are observed to cross cultural

boundaries (Durndell & Haag, 2002; Huber & Schofield, 1998; Kadijevich, 2000; Shashaani & Khalili, 2001).

New Zealand literature reports historical gender differences in students' attitudes towards computers. Vasil et al. (1987) observe that males score higher on computing self-efficacy measures than females, the exception being the stereotypical female activity of keyboarding. McKinnon and Nolan (1990) report that girls in the Freyberg project are significantly less positive towards computers than are boys. Alton-Lee and Praat (2000) conclude that New Zealand research shows that girls' attitudes towards IT tend to become increasingly negative as they progress through schooling, while boys' attitudes remain more positive in their views of IT. They express concern at possible negative changes in girls' attitudes to technology as schooling progresses. They observe that the New Zealand experience seems to be similar to that of the United Kingdom and Australia, where gender differences are maintained in patterns of use and interests amongst older school students. Thus, New Zealand literature is consistent with international literature that describes differences in attitudes to computers and computing practices based on gender.

Students reputedly associate gender differences in computer interests and confidence with differences in ability. It is suggested that boys' greater experience and confidence with home computers leads them to position themselves as more able computer users and to assume that girls lack knowledge, skill and interest in computers. In contrast, girls tend to be less confident about their abilities with computers and more likely to doubt their ability to perform well and to handle difficult computing courses (Beynon, 1993a; Culley, 1993; Young, 2000). Boyd (2000), whose research pertains to use of the Internet by year 11 students in New Zealand, finds that females rate themselves as less knowledgeable than do males and that males are more likely to rate other males as more confident than females in using the Internet. Volman and van Eck (2001) draw on a range of extant research to make an association between experience and performance. They suggest that students who often work with computers perform better than students with less experience, and that these more experienced students tend to be male.

Gender differences in students' computer preferences and computer activity are seen by some as matters of learning orientation or preferences regarding mode of engagement with computer technology. Boys are described as power users who are interested in controlling the technology and who derive pleasure from beating the machine. For them the computer is a toy. In contrast, girls are described as task oriented users, who focus on the social and utilitarian functions of computers. Crawford et al. (1990) suggest that successful girls see computers as a tool to be used for a purpose and resist engagement with computers as a toy; also, that exploratory computer users are almost always male, who tend to be bored and unchallenged by school courses. In her work relating to a group of New Zealand students' uses and perceptions of the Internet, Boyd (2000) reports that females and males use the Internet for similar activities. However, the priorities they give to these activities differ. Females are more likely to be cyber-nerds, who use the Internet for schoolwork, and males are more likely to be cyber-players and use the Internet for entertainment, such as surfing the net and gaming. The females in the study tend to use the Internet in ways that are more directly social, such as accessing the Internet in pairs, sending e-mails to each other whilst in the same room, and engaging in parallel play where they sit together and look at the same web sites.

For some, gender differences in learning orientation reflect fundamental cognitive differences (for example, Sutherland & Hoyles, 1988; Littleton, 1996). For others it is a matter of style or personality. Turkle (1984) argues that males and females approach computer programming differently. Girls, she suggests, tend to be soft masters of computers, while boys are almost exclusively hard masters. Hard mastery involves the imposition of will over computers through the implementation of a premeditated plan. Whilst there is room to adjust and debug programs, the goal of programming is to realise the plan. This is an instrumental or engineering model of computing. In contrast, soft mastery is more intuitive and interactive. It involves tinkering and is the approach of the artist who works with materials, who arranges and rearranges a set of concrete elements. These two approaches reflect Levi-Strauss' concepts of the scientist and the *bricoleur* (Turkle, 1984; Turkle & Papert, 1990). In the New Zealand context, Selby and Ryba (1993) note that girls and boys tend to interact differently with computers and with each other during learning episodes, that girls tend to favour collaborative forms of learning and engage in shared problem-solving and that boys tend to

work more individually and orient themselves primarily towards the computer and secondarily towards people. In referring to gender specific styles of learning there is an assumption of essential gender differences that affect the particular uses that boys and girls make of computers, albeit an unconscious supposition of essential difference. This echoes the international literature of the time that suggests that girls and boys have different learning styles, which affects the way they engage with computers (Culley, 1993; Hoyles, 1988).

Recent international research suggests that patterns of use that reflect gendered computer preferences are changing as males and females have become more frequent computer users. Gender preferences appear to be breaking down as computers have become a feature of everyday life and are used in a range of contexts. Barriers to access have diminished and the association of computing with mathematics and computer science classes has weakened (Jennings & Onwuegbuzie, 2001; North & Noyes, 2002; Schott & Selwyn, 2000). Colley and Comber (2003) note that information and communication technology (ICT) is now much more widely used in the school curriculum. They observe that there is evidence of a reduced gender gap regarding student use of word processing, graphics, programming and mathematics applications. Also, they find no overall gender differences in frequency of use regarding more recently developed technology, such as use of e-mail, the Internet and CD ROMs. Presumably these findings pertain to in-school and out-of-school computer use. Others similarly find that boys and girls access and use computers regularly for entertainment, particularly the Internet (Gardyn, 2003; Volman & van Eck, 2001). E-mail has been referred to as the “killer application” of the Internet because of its broad and popular use (Jackson et al., 2001, p.365). Some challenge the ideas that females tend to be technophobic, hold less positive attitudes about computers and experience greater computer anxiety than males. In fact, some claim greater anxiety for males in particular situations (King, Bond, & Blandford, 2002; North & Noyes, 2002; Tsai, 2002). In different contexts, then, it appears that gender differences in attitudes towards computers may not be as strongly defined as the bulk of early literature suggests.

A weakness of much of the research relating to gender and students’ attitudes towards computers is a failure to recognise the varied nature of IT that is a feature of schooling in the 1990s and new century. For example, the methodology employed by Young (2000) makes no

attempt to distinguish between types of applications in reporting on students' attitudes to computing. According to Volman and van Eck (2001), little research has been done on the differences between students' attitudes in relation to different IT applications, even though computing now covers a broad range of applications. They claim that there is a continuing problem with research on computer attitudes deriving from the use of questionnaires that make no distinction between different computing practices. Mitra et al. (2000) likewise claim that inadequate attention is given to discriminating between various possible computer uses in research. They report that different categories of use are related to different categories of attitudes amongst tertiary students. It appears, then, that some attitudinal research may give a biased picture. Focusing on a computer science model of computing tends to highlight those things about which girls are most negative and fails to identify those aspects of IT that they are reputed to find more enjoyable and over which they exhibit greater confidence – such as word processing and communication applications. This may misrepresent females' involvement with and attitudes towards computers. Females may have more positive attitudes towards computers and computing than are recognised in the literature.

Nevertheless, there are persistent reports that males prefer some computer applications and females prefer others types of software and activities. International research suggests that males continue to dominate at gaming and that they have more experience of the Internet than girls, with the exception of e-mail (Jackson et al., 2001; Schumacher & Morahan-Martin, 2001; Wilson, 2002). Research in the 1980s and 1990s suggests that gender differences in attitudes are linked to preferences for different types of the computing activity. Girls are reported to have a greater preference for communications applications and activities focused on presentation and writing, and boys for games and applications of a mathematical nature. Males are thought to have more positive attitudes towards computers and females to be more negative or sceptical computer users, although there are reported exceptions to this general trend. The literature also suggests that males and females relate differently to computers. Females seem to be more task/work oriented and to focus on the product, whereas males appear to be more machine/play oriented and to like manipulating the technology for its own sake. Males are reputed to be more individualistic and competitive in their computing orientation and females to be more socially inclined. Males are portrayed as more experimental and risk taking, whereas females are presented as more cautious users.

Male domain and culture

Research describing gender based preferences for different forms of computing leads to the idea that computing is a male domain, specifically in computer science and related fields. Male dominance is accounted for as a matter of culture. Computer culture is associated with male traits or symbols such as control, aggression, analytical processes and technological power, which leads to ideas that computers are machines for men and boys (Cockburn, 1985; Culley, 1993; Wajcman, 1991). The creation and maintenance of a masculine culture around computers in schools is thought to discourage female involvement in computing (Jenson, de Castell, & Bryson, 2003; Jenson & Rose, 2003; Schofield, 1995). It is also thought that students are socialised into gender-stereotyped roles, which contributes to a male computing culture and sustains computing as a male province (Dryburgh, 2000; Schulz-Zander, 1990). International literature describes social conditions where females are discouraged from participating in subjects such as science, mathematics and computer science. This is not to say that women and girls are not involved in computer science at school or elsewhere, but that broader social structures and mechanisms tend to work against their involvement.

...to accomplish equity - in this case, to encourage girls' interest in and involvement with computers, to encourage girls and women to enter technology careers - schools swim against the current of many streams. For every teacher who insists that girls become knowledgeable about computers, girls are receiving the constant message from television, radio, the print media, families, friends, other teachers, even the video arcades, that computers are *really* for males. (Sanders, 1990, p.187)

The idea of computing as male culture is prevalent in the literature of the 1980s and 1990s. For example, Chen (1986) hints that there is something about the nature of specialist computing courses that puts girls off computing and that suggests that “the development of skill with computers is more socially approved and offers more social incentives in the culture of adolescent males than females” and that “the stronger male bonds surrounding computer use may also act to develop and reinforce males’ greater self-confidence with the technology” (p.279). Newton and Beck (1993) describe computing as having a male image: “...the image of computing has become predominantly a male image – tied up with notions of 'boys' toys', of male power and of fascination with technology” (p.132). More recently, Crombie and Armstrong (1999), in a Canadian study, find that all-female computer science learning

environments enhance the computing experiences of girls compared with those in mixed-gender classes. Girls participating in all-female computing classes show greater confidence, more positive intrinsic motivation and intentions to pursue further education and careers in the field of computer science, and less stereotyped attitudes about the appropriateness of computer science for females than do girls in mixed-gender classes. The suggestion is that there is something in the culture of mixed computing classes that negatively influences females' attitudes towards computers and computing, something in the gendered culture of the classrooms.

It is argued that cultural symbols of computing, with their strong male associations, are far more likely to alienate girls than boys. A male computer world is produced and reproduced in schools and early childhood environments, where boys tend to take over, claim superior knowledge, dominate discussion and teacher time, dominate the machinery and make girls feel unwelcome or inadequate (Alton-Lee & Praat, 2000; Culley, 1986; Haisman, 2001; Purdue, 1994). The attitudes and actions, or inaction, of teachers are seen to discourage females from participating in computing activities (Alton-Lee & Praat, 2000; Beynon, 1993a, 1993b; Culley, 1993; Newton & Beck, 1993). The prevalence of a male computer culture is thought to account for the absence of women in tertiary information technology courses. For example, Newton and Beck (1993) argue that girls in the United Kingdom have been systematically discouraged from applying to take computing courses due to previous negative experiences of computers and perceptions of computers as a career. Ryba and Selby (Ryba & Selby, 1995; Selby, 1995) take a similar stance. They argue that the lack of participation and high drop out rates of females in computing courses at tertiary level in New Zealand is because "computing 'culture' is exclusive in nature with the result that women *choose* not to be part of it" (Ryba & Selby, 1995, p.2).

Some suggest that the computer industry supports and promotes males' computing interests and culture, especially in the field of computer gaming. Males are reported to frequent computer clubs and computer arcades far more than females. It is argued that games software is developed mainly for a male market, designed by men for men, although there are exceptions of games that are designed specifically for females. There is stereotyping of male and female images in games and the subject matter tends to be of greater interest to men and

boys. Males are also thought to be more comfortable with the competitive nature of gaming. Research reveals that gaming is less appealing to girls than to boys and that girls tend to view computer games as boys' toys, and to find the computer gaming environment of arcades hostile, socially appropriate, offensive or boring. It is observed that boys' social networks often have computers at their core (American Association of University Women [AAUW] Educational Foundation Commission on Technology, Gender and Teacher Education, 2000; Crawford et al., 1990; Culley, 1993). Presumably this is less common in girls' social groups.

Crawford et al. (1990) find that historical links between masculinity and computing, the association of computing with mathematics and between computers and games, have established computing as a male domain in the minds of students. In interviews with Australian secondary students they find that most girls spoke of brothers who had computers, of fathers who used computers for work, and of social isolation and a social cost to girls who demonstrated competence with computers. Consequently girls tended to express frustration and ambivalence in their attitudes towards computers and the usefulness of the technology, and a reluctance to take risks in the face of male jealousy and hassling behaviour. However, some other writers describe student resistance to notions that computer technology is a male domain. Chen (1986), for example, reports that the girls in his study did not view computers as representing an alien domain in which females hold fewer chances of success than males, although they were more anxious and less confident computer users. Similarly, the results of a study by Young (2000) show that males see computers as a male domain, but that females reject such claims.

The idea that computer culture is a male culture supposes that males' interactions with each other around the computer are in some way discomfiting for females. Sofia (1998) investigates the emotional nature of people's relationships with computers and finds marked gender differences. She argues that it is not the excessive rationality or abstraction of computer logic that turns girls off computers, but the masculine irrationalities associated with computer use. According to Sofia, it is the competitiveness, passions and fantasies exhibited by males for the technology that tend to alienate females. However, such irrationality is legitimated in the culture of computer gaming and technophilic approaches to computer learning and computer interactions. Some argue that it is the social practices surrounding the

use of software that dissuades girls from engaging with computers, rather than the software *per se*. Turkle and Papert (1990), for instance, contend that computer technology supports epistemological pluralism, that is, different approaches to computing and programming, but that such pluralism is not supported by the dominant male computer culture.

The perpetuation of male computer culture is attributed by some researchers to school structures and to the actions, or inactions, of teachers. A lack of female role models and the biases of computing teachers are thought to discourage and alienate girls from computing. It is observed that computing teachers have traditionally been male and that male teachers tend to have more elitist views of technology than do female teachers. This results in greater encouragement being given to boys, who tend to be the expert or more skilled students in computer classes. It is thought that girls are likely to receive less encouragement to use computers than are boys (Culley, 1993; Newton & Beck, 1993). Teachers' actions in selecting software and structuring classroom activities are questioned. Littleton (1996) suggests that the nature of the software influences student performance. In particular, girls are likely to perform better when they can identify with the characters and situation. Using gender neutral software appears to make a difference to girls' achievement, whereas boys' achievement is comparatively unaffected. Her research shows that marked gender differences in performance exist in mixed-gender groups of primary students. However, these only occur when students work alongside one another but do not interact with each other. Littleton speculates that in such mixed-gender situations the boys are challenged to achieve well, while girls may be inhibited by low expectations of their own likely performance. Beynon (1993a) observes that girls often show up as superior communicators and computing instructors when students work in groups, if the girls are allowed to participate on an equal footing with the boys and boys are not allowed to dominate the computers. However, recently the prospect has been raised of a broadening gender gap in access to school computing qualifications that reinforces the position of computing as a male domain. It is reported that in Great Britain male domination of computing as a subject has led a number of girls' schools not to offer qualifications in computing (Henry, 2001).

Thus, the idea persists that computing is a male domain, or perhaps more accurately, that the computing practices associated with computer science and the IT industry are male domains of

practice. This is despite reports in international literature that there is little evidence of differences in females' and males' ability with computers, in the school and tertiary sectors (Beynon, 1993a; Culley, 1993; Littleton, 1996; Ryba & Selby, 1995; Siann, 1997). By implication, different computer practices could be seen to constitute female domains. However, the literature in the 1980s and 1990s focuses on a computer science model of computing. In effect computing is defined by males' preferred practices and identified with male computer culture.

Female deficit

The identification of computing, defined as computer science, as a male domain and the apparent lack of female involvement and interest in this field is perceived as an equity problem. It is alleged that boys' computing experiences makes them more suitably prepared for the world of work and therefore advantaged compared with females. This has led to a deficit perspective and to deficit talk pertaining to girls and their computer use and schooling. Girls are seen as deficient because of a perceived lack of interest and experience of computing practices that have traditionally been dominated by males, such as programming. The deficit perspective comprises discourses of disadvantage and deficiency.

The discourse of disadvantage identifies problems for women and girls in their lack of participation in specific types of computer related practices, particularly their lack of involvement in computer science at school, and in related IT careers. This notion of disadvantage is exemplified in the following excerpts.

Computer-competency is not an option any more. It is a condition of citizenship in the electronic world...

Despite the belief of some individuals, the computer is not a toy; it is a site of wealth, power and influence, now and in the future. Women - and Indigenous people, and those with few resources - cannot afford to be marginalised or excluded from this new medium. To do so will be to risk becoming the information-poor. It will be to not count; to be locked out of full participation in society in the same way that illiterate people have been disenfranchised in a print world. (Spender, 1995, p.xvi)

And

As computers continue to develop a more pervasive presence in educational and work related environments, adolescents who are computer literate will have a greater range of future options than adolescents who are not... Gender differences in computer related attitudes and behaviours

are a potential concern since these differences may lead to the development of a computer literacy gender gap...

Gender differences in computer related attitudes may contribute to gender differences in both enrolment patterns and in the pursuit of high technology occupations. (Crombie & Armstrong, 1999, pp.317-318)

Disadvantage is seen to accrue to females because they fail to contest a share of the wealth and power in the IT world.

A discourse of disadvantage is clearly evident in the Australian study by Chambers and Clarke (1987) on the relationship between disadvantaged group membership and students' computing experience, knowledge, attitudes and intentions to enrol in further elective computing courses. They focus on four groups of predefined "disadvantaged students", which includes girls as one of the four groups (p.499). It is intimated that girls are disadvantaged because they lack breadth of computing experience, which may adversely affect their ability to function as citizens in an increasingly technological society, to gain employment in a labour market where computing skills are increasingly a feature of job requirements, and to develop their general cognitive skills. The New Zealand literature of the period similarly reflects a discourse of disadvantage. For example, Vasil et al. (1987) express the opinion that if apparent discrepancies in boys' and girls' levels of access and application with computers continue, then "the girls of today may be severely disadvantaged in the technologically advanced workplace of the future" (p.201). Churchman (1993) rues the lack in numbers of females choosing computers as a major field of study in New Zealand, and the male domination of computing across a broad spectrum of uses, including game-playing, designing, calculating, the generation of data banks, lower level and higher level programming, systems design and development, and electronics theory and practice. In her opinion, unequal participation in computer learning environments is a concern because it exacerbates the differences between males and females and denies women opportunities to gain the higher cognitive skills that are acquired through computing practice. It restricts the ability of women to participate in society and fails to meet the needs both of individuals and of society in general.

In reporting the results of their Ministry of Education supported research, which investigates the conditions that affect the inclusion of women within tertiary computer science and information technology courses, Ryba and Selby (Ryba & Selby, 1995; Selby & Ryba, 1993)

conclude that there is serious under-representation of women in tertiary computer related education. Women are disadvantaged by being under-represented in ‘hard’ computing fields, such as programming and systems analysis and design, and over-represented in ‘soft’ computing areas, including graphic art, word processing and office applications. Selby (1995) claims that there is “nothing optional any longer about computing involvement for any of us” and that it is essential that both men and women understand computer technology and the electronic media – “they *must both* contribute to the use of computers as a productivity tool, *as well* as to the building of computer software and systems upon which our everyday lives depend” (p.25). Drawing on Spender’s ideas that information is power, Selby implies that lack of involvement in the authoring of software and in activities that explore the potential of computer technologies will disempower and disadvantage women.

Allied with the discourse of disadvantage is a discourse of deficiency. Blame for the perceived inequity is located with females. The fault is seen to lie with women’s and girls’ lack of interest, enthusiasm and application for computing. Girls are construed as deficient in their lack of confidence, self-esteem and assertiveness, which denies them the same outcomes as boys (Alton-Lee & Praat, 2000; Bryson & de Castell, 1995). For example, Chen (1986) finds no differences in levels of interest in computers amongst females and males who have similar exposure to computing technology and suggests that “a chief source of gender differences in attitudes is the greater willingness of males to participate in computer experiences” (p.278). By implication, it is the attitude of females, their unwillingness to participate, that is a problem. Crawford et al. (1990) note that teachers tend to attribute girls’ relative passivity in the face of male domination to girls’ lack of initiative. Girls are seen by teachers to be deficient in their attitudes relative to boys, and the problem of girls’ relatively low levels of engagement with computers is attributed to the girls themselves. However, the literature does not necessarily blame females directly for the situation. The problem may be seen as a result of socialisation processes that establish different gender stereotypes for boys and girls. Whatever the attribution of cause, the solution is to change girls’ attitudes to computers and computing, to change the way they think. Boys and their thinking go largely unquestioned.

...boys have rarely been the focus of gender policy throughout the development of discourses of equality, disadvantage, difference, and equal outcomes in New Zealand gender policy. Rather, the focus has been on achieving equity for girls in relation to boys, who have typically been positioned

as an advantaged benchmark group in equity discourse. That John was running while Janet was watching was constituted as a problem for Janet but not for John. (Alton-Lee & Praat, 2000, p.51)

Deficit discourses are also a feature in the current populist New Zealand business media. A problem is identified in the lack of women in the IT industry; that is, in careers such as programming, systems management and design. Women are observed to dominate clerical fields, such as the data entry occupation group. Concern is expressed at the lack of female interest and involvement in tertiary level computer studies and information systems courses, and also in high drop out rates of women from such courses. This results in an unbalanced workforce and it is argued that the nation will miss out as a result, presumably from untapped human capital. Females' lack of interest and involvement in computing is explained as a matter of their misguided perceptions. They are thought to erroneously associate IT work with geek and tech-head stereotypes and to resist these typecasts. Females' disengagement is also attributed to schooling. It is argued that schools do not present the right messages about IT careers and training and that they do not expose students to the right kind of computing, which is defined as 'hard' computer science. It is suggested that students are not prepared for the rigours of programming. Thus school leavers, and girls in particular, are seen as in someway deficient. Solutions are couched in terms of public relations and education strategies to inform girls about the range of careers that are available in the IT industry (Martin, 2003; Radio New Zealand, 2003; Smith, 2001; Wells, 1998). A discourse of deficiency clearly underlies the following reported opinion of Catherine Calarco, marketing director for Hartford Consulting and co-chair of the government's e-commerce action group.

Calarco agrees that the IT industry has an obligation to encourage talented women. "But at the end of the day, the onus is on the women to take up those opportunities and go for it."

Women chronically underestimate their own abilities, she says. "They feel they have to know everything to do well. They don't. They just have to realize what they're good at and be confident in that." (Martin, 2003, p.70)

The problem is seen to lie with females and the solution to lie in changing their attitudes. Little serious attention appears to be given in the populist industry media to possibilities for changing the nature of tertiary technical computing courses or cultures in IT industry work places. These appear to be immutable features of IT institutions.

In summary, employment patterns show a tendency for women to be under-represented in 'hard' computing fields, such as programming and systems analysis, and over-represented in 'soft' computing areas, including graphic art and word processing. This is interpreted as a gender equity problem. Those concerned at females' lack of participation in computing tend to perceive two main problems – the potential losses to the national economy and society in general that accrue as a result of failure to develop females' skills, and, at a personal level, the loss of opportunities for individual women as they are disenfranchised from computer knowledge and excluded from power. Something is seen to be wrong in the way computing knowledge and skills are presented to girls at school, and something is wrong with girls and their attitudes. Girls are seen as both deficient in their lack of interest in 'hard' computing, and disadvantaged by being unprepared for participation in IT industries. The problem of girls and computing is defined as an equity issue for schools. Concerns are expressed at apparent disparities in boys' and girls' levels of participation and engagement with computers, particularly in girls' numerical under-representation in computing related fields of study.

Culture change

There has been a movement for change in the way computer education is organised and presented in schools in recent decades. The intention is to alter the culture of computing and to get more students, including girls, involved with computers at school. In particular, there has been a push for cross-curricula computing. Attempts to integrate IT as a curriculum component across a range of subjects, such as social studies and science, represent a dispersal model for IT education. Such initiatives aim to reduce competition for resources and make computers more accessible by locating computers in classrooms, and to change the way IT is used and presented to students in schools. This reflects a shift in the equity discourse to a focus on the culture of schooling and social structures that sustain gender differences in computing practice.

Some advocate for pedagogical change as a means of reducing perceived gender inequalities. For example, Jenson et al. (2003) support interventions to restructure what have traditionally been masculine communities of computer based practices in schooling, one specific intervention being to train female student experts and instructors before training their male

counterparts. Spender (1995) advocates a move away from instructionist teaching to a constructionist approach, where students have greater autonomy to direct their own learning and where computers are used in the classroom context to perform a variety of information functions. It is thought this will encourage a more student centred, problem-solving orientation. The aim is to empower students and make them more information literate and confident in using computers for a variety of purposes. In the New Zealand context, Ryba and Selby (Ryba & Selby, 1995; Selby, 1995) perceive a need to make the use of computers in tertiary education more relevant to the interests of males and females and advocate for change in classroom social practices through the use of interactive and collaborative forms of learning that females are thought to prefer. Part of the problem of differences in males' and females' levels of participation in technical computing courses is seen to lie with the teaching methods and examples used by tertiary teachers, which are irrelevant to the interests and experiences of their students. Two strategies are promoted to increase women's participation in computing – changing the culture of tertiary computing classroom, including teaching methods, and changing the images of computing presented to girls in schools through careers education that presents computers as tools for information processing and dispels stereotypes that computing is for nerds, geeks and macho males. They contend that strategies that challenge the culture and learning environment in tertiary computer courses will do more to encourage greater participation of women and other under-represented groups than attempts to make the people change to fit the culture. Alton-Lee and Praat (2000) argue that teaching competence is critical to the success of classroom IT programmes at secondary level and imply that teachers need to be more proactive in directing computing activity in classrooms in order to provide more equitable learning opportunities for students.

Proponents for pedagogical change see this as a way of softening the image of computer education and making it more interesting, palatable and pertinent for a wider range of students, especially girls. It is thought that reducing the emphasis on technocratic and mathematical practices and providing a more collaborative IT learning environment would make computing more appealing to females. Pedagogical approaches that have been advocated as particularly appropriate for females include: adoption of a computers-as-tool construction of computing (Clarke, 1990); more conscious use of direct and explicit instruction pertaining to software features (Churchman, 1993); explicit attention to the construction of male and female gender

stereotypes in the selection of software and classroom discussion (Culley, 1993); the creation of a collaborative and interactive learning environment through the use of group activities, investigations, shared problem-solving, discussions about social issues and peer evaluations (Blakely, 1994; Selby, 1995; Selby & Ryba, 1993); and greater teacher attention to the structures of male and female dynamics in group management (Beynon, 1993a). The goal is to modify the social practices of IT classrooms and thereby create a female friendly computing environment and culture in schools.

A range of initiatives saw structural changes made to the way that computer education was organised in New Zealand secondary schools in the 1980s and 1990s. These tended to take the form of cross-curricula innovations that broadened the scope of what constituted computing and provided for use of a range of applications in different subject contexts (Blakely, 1994; Boyd, Kelliher, Scott, & Pech, 1998; Churchman, 1993; Nolan & McKinnon, 1991). For example, the Freyberg project involved the integration of core subjects at years 9 and 10 (English and social studies; mathematics and science) and the extended application of computer technology within those subjects (McKinnon & Nolan, 1990; Nolan & McKinnon, 1991). A Ministry of Education supported IT project at Palmerston North Girls' High School involved the integration of IT in accounting, economics and mathematics. This initiative introduced students to a range of data management and presentation applications in the course of their curriculum studies – applications included word processing, spreadsheets, graphics and drawing programs, specialist statistics software, and information sources such as PCInfos and MACGlobe (Boyd et al., 1998). Other IT initiatives have included networking projects and school-wide computer laptop programmes for students and teachers.

Changes in computer organisation and teaching in New Zealand schools and the move to cross-curricula computing are matters of government policy. The curriculum review of the 1990s resulted in the New Zealand Curriculum Framework document (Ministry of Education [MOE], 1993), which is the basis of the current national curriculum. This document establishes eight essential skills that apply across all curriculum areas, which include communication and information skills, and identifies ICT related goals for all learning areas. It is expected that students will “become competent in using new information and communication technologies” and be able to “use a range of information-retrieval and

information-processing technologies confidently and competently” (MOE, 1993, p.18). These curriculum developments are consistent with a general goal to ensure that all students are able to “develop their potential, to continue learning throughout life, and to participate effectively and productively in New Zealand’s democratic society and in a competitive world economy” (p.3). The drive to redress gender imbalances and change computer culture in schools is part of a broader policy shift to provide for and expand IT education in the form of cross-curricula ICT.

Ironically, there is potential to reinforce rather than reduce gendered computer cultures in reformist calls for curriculum change. Bryson and de Castell (1995) identify a paradox in the positioning of girls as disadvantaged and disenfranchised computer users and the implementation of policies to reduce gender discrimination in computing. They claim that the instructional practices that are intended to promote gender equity actually embody exclusionary values and are “more likely to entrench discriminatory practices and to reduce their range of possible relations to technology than to empower the oppressed” (p.23). An example of this might be the movement of computer education into the curriculum contexts that it is thought are favoured by girls, such as English composition and information handling, in an effort to reduce the self-limiting stereotypes adhered to by women. In effect such moves may reinforce stereotypes that associate women and girls with particular types of computing practices.

Extrapolating to the New Zealand situation, the drive in New Zealand schools to soften the computing culture and make it palatable to girls by focussing on applications based IT and cross-curricula computing may actually strengthen the deficit discourse relating to girls and computing. In creating forms of IT schooling practices that girls find more enjoyable and pertinent in their daily lives, there may be even less incentive for girls to involve themselves in ‘hard’ computing courses. Also, with IT becoming a much more common feature in homes and schools in the past decade, girls can presumably get extensive exposure to and familiarity with computers and a variety of applications without pursuing computer science or related practices. However, a lack of research relating to different curriculum arrangements means that at this stage such claims are largely speculative.

Critical discourse of gender and IT

Deficit ways of thinking are challenged in a body of literature that emerged in the 1990s, which disputes ideas that females are in some way deficient because they do not enjoy or participate in particular forms of computing.

Gendered experiences and identities are formed in complex ways and the work we have reviewed suggests that the women and computing debate cannot be conceptualized as female lack (Henwood, 1996; Clegg et.al., 1999). Nor, is the absence of women in computing a general phenomenon; rather, women are underrepresented in particular forms of computing. (Clegg & Trayhurn, 2000, fulltext, ¶13)

Critical discourses challenge a tendency to essentialise gender positions; that is, to assume sameness between women and between men. There is a move to deconstruct the binaries that tend to define male and female computing practice in mainstream and liberal feminist literature, to investigate the complexities of males' and females' computing experiences and focus on individual difference (Bryson & de Castell, 1998; Trauth, 2002). Terms such as "IT" and "gender" are viewed as problematic. Researchers look below the surface meanings for the assumptions on which understanding is produced, focusing on the discursive and social production of meaning and gender relations (Bryson & de Castell, 1995; Butler, 2000; Carr-Chellman, Marra, & Roberts, 2002; Clegg, 2001; Clegg & Trayhurn, 2000; Singh, 1993; Singh, 1995; Stepulevage, 2001). Critical commentaries question the taken-for-granted male perspective on computing and challenge the stereotypes of male and female computer users. The intention is to unsettle and challenge the power of assumptions. In relation to IT schooling and gender, critical discourses commonly challenge the association of masculinity with particular forms of computing and the ascendancy of these practices in education. The problem of girls and IT schooling is reassessed and the nature of computer cultures is interrogated (AAUW, 2000; Elkjaer, 1992; Jenson et al., 2003).

Defying gender stereotypes

An emerging literature questions notions that females as a group are less experienced, less confident computer users than males, that they dislike what have traditionally been male domains of computing practice, and that they are reluctant to embrace new technologies. For example, Spender (1995) presents a positive view of women's computing future, arguing that

women who natter on the net and appropriate the cyber world for their own purposes are models for the future. She observes that, at the time of writing, men have the power in cyberspace, but that this is not an immutable situation and that cyberspace will be transformed once women are convinced of the necessity and desirability of being involved in the cyber world and join this world. Bjorkman, Christoff, Palm and Vallin (1997) note that some women adjust comfortably to male dominated IT culture, based on research relating to the experiences of participants in tertiary level computer programming courses in Sweden. They suggest that traditionally gendered (male) domains of practice may be breaking down and that the traditional stereotypes of computer phobic females may not apply in some situations. Christie (1997) contends that overall both males and females defy gender stereotypes relating to interest and engagement with computers more often than they confirm them. In her research relating to e-mail telecommunications in an elementary class, she finds that girls see computers as tools that foster collaboration, but that girls also view them as fun technology that helps to build independence. Boys likewise define computers as fun technology and they associate computers with games, but boys also find computers frustrating and see them as tools for building relationships. Both girls and boys are active and interested players, rather than spectators, in the use of e-mail communications.

Some note that differences persist regarding the participation of males and females in different IT practices, but they challenge ideas that this is the result of females' lack of interest and confidence with computers *per se*. Green (2000), reporting on the findings of the AAUW Educational Foundation Commission on Technology, Gender, and Teacher Education (2000), notes that American girls now participate in mathematics and science classes in almost equal numbers to males, but that they continue to be under-represented in computer science classes. However, girls are using the Internet and e-mail as much as boys. It is specialist computer science, programming, engineering and IT courses and careers that they avoid. The commission portrays girls' rejection of computing as a matter of conscious choice resulting from disenchantment.

Siann (1997) argues that computers have become so ubiquitous that young people, male and female, use them in almost all occupations. She observes that gender differences in use at school are also diminishing, except in relation to computer games, where males still dominate.

Based on the research by Durndell et al. (1995), she argues that girls' lack of involvement in computer gaming is not a matter of lack of confidence. Rather, girls are uninterested in particular forms of computing practice. She also argues that young women make constructive decisions not to pursue tertiary education and careers in computer science, rejecting such a life path for positive rather than negative reasons. The exclusion of females from computer science is a matter of positive self-interest, rather than a lack of confidence or self-efficacy. Durndell et al. (1995) ascribe differences in participation to the notion of "pragmatic advantage" (p. 226). They suggest that once females become convinced of the usefulness of computers they are happy to use them. The implication is that girls like computers. It is particular practices that individuals react against.

A critical perspective on gender and IT use has led to new interpretations of apparent differences in males' and females' computer interests and engagement. Notions of female inadequacy are questioned. For example, it is reported that some girls and women acknowledge gender differences in achievement and see themselves as lacking in confidence with computers, but they do not construe these as matters of general female incapacity. This is epitomised in the maxim "We can, I can't" (Sanders quoted in Durndell et al., 1995, p.220). However, it has been suggested that this maxim should be revised to "I can, but I don't want to" (Durndell et al., 1995, p.221; Siann, 1997, p.120). This revision is intended to reflect the pragmatic views and rational decisions made by girls and women to avoid forms of computing that they find are of little use or interest, or that they associate with an image of the computer nerds that they do not share or want to be part of. It also draws into question the idea that gender differences in interest and participation are simply a matter of confidence (Clegg, 2001; AAUW, 2000). It could be argued that females are acting to change the culture of computing, rather than changing themselves to fit the dominant culture (Green, 2000).

Assumptions that there are essential differences in the way males and females interact with computers are also brought into question. Learning styles or approaches can themselves be seen as collaborative products of particular social and cultural settings and as simplistic and superficial categorisations (Bryson & de Castell, 1995). Based on the work of Turkle and Papert (Turtle, 1984; Turtle & Papert, 1990) and Weizenbaum (1976), one could conclude that an emphasis on 'hard' mastery and mathematical logic in school computing courses has

encouraged males and discouraged females from pursuing computer science. However, there are problems with reifying the notion that male thinking and ways of doing computing, particularly programming, are analogous. Mahoney (2001) draws on the work of Håpnes and Sørensen (1995) to challenge apparent certainties about the masculine nature of computing. It is reported that in the Norwegian context the practices and attitudes of hackers straddle gender lines, which is contrary to expectation. Hackers are competitive but communal and mutually supportive. They are ‘hard’ masters who are open to strategies of ‘soft’ mastery. They are fascinated by the machine, but want to create useful programs. Mahoney attributes the differences observed between the American and Norwegian situations to the type of programming system in which people are operating. Whatever the reason, this work brings into question assumptions that there is something essential and unique in the way males and females think and interact with computers.

Care needs to be taken not to assume that attitudes towards particular computing practices and attitudes towards computers necessarily equate, nor that negativity towards particular computing practices necessarily results in avoidance of computers or computing, or that all girls and all boys interact with computers in similar ways and are naturally more or less confident with computers and have different attitudes and computing abilities. Girls may tend to be more critical and polarized in their attitudes towards computers and prefer using the Internet to programming, but this does not mean that they all necessarily dislike or reject the technology. Computer practices have changed with a burgeoning of computer applications that support daily activities, such as communication *via* Internet and e-mail. Gender issues differ, depending on the computing context. Although differences are reported in males’ and females’ general attitudes towards computers and computing and there are gender stereotyped domains of IT practice, it is apparent that blanket assessments and conclusions that boys are more confident, interested and have greater skills and IT knowledge are overly simplistic.

Reframing the problem

There is a growing literature that questions the tendency to blame girls and women for their lack of participation in computer science related practices. For example, Selby and Ryba (1993) challenge the discourse that labels New Zealand girls and women as deficient. They criticise strategies to increase girls’ use of computers that involve providing girls with more

female teachers and female role models in computing education and providing encouragement to girls to enrol in computer studies. In their opinion, such strategies are superficial – “this is because they define the problem as residing with girls and their need for compensatory education to bring them up to the standard of the boys by giving them more of the same” (p.6). Recent literature turns attention instead to the nature of computing culture and schooling. Responsibility for females’ lack of interest in ‘hard’ computing is repositioned and attributed to discursive practices that define computing in male terms; that is, according to male interests.

The recent literature pertaining to gender and IT schooling maintains concerns that women and girls are disadvantaged in their lack of participation in particular computing fields. However, responsibility for female lack of interest and participation in computer science and related subjects is attributed to historical processes that privilege particular forms of computer knowledge, particularly those which have been dominated by males. Historical accounts describe IT as a field that has come to be controlled by males, primarily because of their dominance of science and engineering forms of computing practice, including programming, systems management, and hardware design and production. Social developments that are cited as having led to the appropriation of computing as a masculine domain include the early identification of computing with computational and military functions, its later association with male gaming, and the early association of school computing with mathematics and science. The argument is that IT is seen as a male domain because the field was appropriated early on by men (Kirkup & Smith Keller, 1992; Mahoney, 2001; Wajcman, 1991). Schools and universities are portrayed as historical sites of the production and reproduction of masculine forms of IT, associating computing with mathematics and reproducing gendered expectations and patterns of computer use (Clegg, 2001; Crawford et al., 1990). The media is also observed to present computers as a masculine domain in the field of entertainment, with its association with violent and competitive computer games, and in the corporate world of work (Carr-Chellman et al., 2002; Kirkup & Smith Keller, 1992). It is argued that the way computer schooling is organised privileges particular forms of computer knowledge, contributes to gender differences and creates inequalities that disadvantage females.

Clegg and Trayhurn (Clegg, 2001; Clegg & Trayhurn, 2000) are critical of educational and social developments that tend to reinforce women's roles as computer users and not computer experts. They are sceptical of the tendency to blame girls' reluctance to embrace computer technology at school on girls' lack of confidence or boys' poor behaviour. Clegg suggests that the problem actually relates to the social construction of the technology. It is rooted in the way computing is framed in the schooling and wider social context.

...the discursive positioning of school computing alongside science and mathematics, areas dominated by boys, has disadvantaged girls. There was nothing inevitable about this. Rather, the design and marketing of computers drew on available masculinised concepts of leisure and disciplines. Computing was inserted into already existing gender systems and discourses. Girls, therefore, found themselves already ideologically positioned as outsiders. There is no technologically determined logic to either these historical, or possible new, gender positions. However, existing power relations inside and outside schools make it difficult for classroom teachers to contest these meanings. (Clegg, 2001, p.315)

Bryson and de Castell (1998) similarly argue that computers play a role in reifying education as a systematic process of acculturation to the values and normative practices of dominant groups. A covertly entrenched technocratic version of computing creates hierarchies of different types of software and computer learning. The promotion of computers in education may reinforce social differences, including gender differences, by favouring abstract and technocratic forms of computing knowledge. The assumption is that such knowledge is part of a masculine domain.

Cukier, Shortt and Devine (2002) contend that a very narrow definition of IT dominates in industry and academe, which is based on computer science and electrical engineering models that are dominated by males. This is despite evidence of the multi-dimensional nature of IT in workplace practices and a growing overlap between telecommunication functions and knowledge about computer hardware and software in the digital world, which requires a range of hard/technical and soft/communication skills. Presumably females are thought to have stronger communication skills and males to have greater technical knowledge. In their opinion the effect of identifying IT with computer science and electrical engineering is to marginalize women and their contributions in the IT world. They argue that women are represented in higher numbers in information systems management and multimedia fields, including library and information science related work, but that in the narrow IT industry definition of

computing these practices don't count. They also argue that the perspectives of computer users are routinely devalued compared with those of the technical experts.

Solutions are thought to lie in broadening the scope of what counts as computer knowledge and creating an IT curriculum with a critical perspective. Reassessments of what constitutes computing knowledge seek to recognise and legitimate what have traditionally been female computing practices and interests. For example:

Both the academic world and industry need to look very seriously at their current practice. As the field has grown and acquired status and prestige it has become more exclusively male. The bold, hard 'high-tech' image persists, but much of computing is about communication, about the interface between people and computers, about organizing information, and about devising new ways to work. If these images are projected, more women may consider computing as a career. (Newton & Beck, 1993, p.144)

And

Computing is not a unified field, and both women and men are choosing the sorts of ICT courses which involve a broader range of skills. Where our argument would slightly differ from Siann is that we would regard these [business oriented] courses as real computing, just as much as other specialist courses which concentrate on development and use of more formal analysis and design methods... Otherwise the danger is that when women do make breakthroughs into technology we lose sight of it by relabelling it as something else. (Clegg & Trayhurn, 2000, fulltext, ¶12)

Cukier et al. (2002) promote an epistemological change that would broaden the scope of IT education to include multi-disciplinary perspectives, which would involve consideration of the social impacts and unintended consequences of IT developments as part of the curriculum. This is consistent with Gilbert's idea of critical literacy in science, where students are educated about science, rather than trained to be scientists (Gilbert, 2001). The implication for schools and other educational institutions that might consider adopting a critical perspective is the reconfiguration of curriculum to include content relating to the social construction of technology – studying the historical development of computing practices, evaluating the social consequences of computer developments, questioning the form given to computing in schools and work places – as well as building familiarity with the physical technology.

The AAUW commission (AAUW, 2000) similarly challenges ideas of female deficiency and advocates change in the structure and form of IT schooling. The commission notes the persistence of a tool-toy divide, where girls tend to be interested in the instrumental possibilities of computers and boys tend to find computers inherently appealing, and they

observe that girls and women commonly enter the computing world by engaging in courses on computer tools or productivity applications, including databases, publishing and graphics software. They are of the opinion that females' denigration of male computer play and their withdrawal from computer practices that are associated with male interests is a problem because of the potential disadvantage that may accrue to females through their lack of engagement with male forms of computing practice. The commission considers it desirable for more women and girls to be involved in a greater range of computing practices and fields. However, the AAUW commission takes issue with the tendency to blame girls for this situation and to label girls as computer phobic, which deflects attention from the nature of computer culture.

In its inquiries into gender issues in computers and education, the commission found that girls are concerned about the passivity of their interactions with the computers as a "tool"; they reject the violence, redundancy, and tedium of computer games; and they dislike narrowly and technically focused programming classes. Too often, these concerns are dismissed as symptoms of anxiety or incompetence that will diminish once girls "catch up" with the technology.

The commission sees it differently: In some important ways, the computer culture would do well to catch up with the girls. In other words, girls are pointing to important deficits in the technology and the culture in which it is embedded that need to be integrated into our general thinking about computers and education. Indeed, girls' critiques resonate with the concerns of a much larger population of reticent users. The commission believes that girls' legitimate concerns should focus our attention on changing the software, the way computer science is taught, and the goals we have for using computer technology. (AAUW, 2000, p.ix)

It invites a broader critique of computing culture, and promotion of a computing culture that "embraces multiple interests and backgrounds and that reflects the ubiquity of technology in all aspects of life" (AAUW, 2000, p.x). A solution is thought to lie with the re-conception of computer literacy and computer fluency. This would mean moving away from a focus on skills with communication and productivity software (which includes the Internet and e-mail, PowerPoint and page layout programs) as a measure of technological literacy. These skills are thought to meet an older standard of computer literacy and equity, but not the needs of girls in the current and future IT climate.

The new standard of "fluency" assumes an ability to use abstract reasoning; to apply information technology in sophisticated, innovative ways to solve problems across disciplines and subject areas; to interpret vast amounts of information with analytic skill; to understand basic principles of programming and other computer science fundamentals; and to continually adapt and learn new technologies as they emerge in the future. It is our job as a society to ensure that girls are just as competent as their male peers in meeting these standards. (AAUW, 2000, p.x)

While reacting against the tendency to blame girls for their perceived lack of computer knowledge, the commission nevertheless maintains that there is a problem with girls' preferences for particular forms computer practice. The answer, though, is not seen to lie in an advertising or public relations campaign to convince girls that they want and need to engage with computers in a different way, but in changing the way that computer education is structured and presented in schools.

Thus, in the recent literature the problem of girls and their lack of involvement in computer science and related subjects is reframed as a problem of society and a function of the gendered construction of technology. Notions of computing as a male culture are interrogated and are seen to be based on a narrow definition of computing, one that ignores practices that are preferred by females. For some a solution is seen to lie in broadening the scope of what counts as computer knowledge. For others the solution lies in the dramatic reorganisation of computer related schooling in an effort to break down distinctions between male and female computer practices.

Gender and power- knowledge relations

Gendered preferences for different types of computing mean that males and females tend to acquire different types of knowledge and skills. Girls are reputed to prefer subjects and computer practices that prepare them for supporting roles in information processing, rather than in areas of technological control and design. In contrast, boys tend to be more interested in understanding how computers work and in computer science. This positions students in different relations of power and authority with computers, and with each other. That which is perceived as male knowledge tends to be valued over female knowledge, giving rise to a power-knowledge differential. For example, Selby (1995) attributes the over-representation of women in word processing and data entry activities to a service orientation, rather than one of knowledge creation. In presenting men as knowledge creators they are assumed to have greater capacity to control computers, compared with women who are positioned as more passive users of technology. Males are thereby subtly attributed greater status and their knowledge rated over that of females.

The debate surrounding boys' apparent proclivity for computer gaming reveals concern that males' preferred computing practices define what counts as computing knowledge or expertise. Some consider computer gaming to be a misdirected activity that undermines educational goals; others see it as an advantage for boys in helping to prepare them to operate in the world of computers (Alton-Lee & Praat, 2000; Culley, 1993). It is suggested that the recreational interest of the game-playing boys places them in a better position to understand and control future technology. Gaming is attributed greater value than some other types of computing knowledge and game-playing boys attain positions of superiority based on their gaming experience.

Males in our study appeared to take it for granted that games playing constituted 'experience' and yet games playing is an end-use application like word processing. The association of computer games with real computing while word processing retains its link with a previous technology, typing, suggests that for both men and women what counts as 'experience' with a technology is socially framed in a gender discourse. (Clegg & Trayhurn, 2000, fulltext, ¶26)

The type of knowledge that is most highly valued tends to be technical and procedural knowledge that is associated with programming and systems design. Ironically, the knowledge and skills that are associated with the lesser status traditional female computer uses – routine clerical and communications activities of office practice, such as typing/word processing and information presentation – are also essentially procedural in nature, involving mastery of particular software functions to create text products. However, this is attributed lesser value than the procedural knowledge that tends to be held by males. The privileging of male computer activity and knowledge may lead to girls' achievements being under-valued and boys' abilities being over-rated.

Boys and girls achieved similar examination results but girls were seen as successful largely because of their diligent and methodical approach to the subject, while boys were regarded as having more 'flair' for computing than girls... Although some boys 'fail' they are nonetheless seen as enthusiastic and powerful computer users. Girls may achieve well in coursework and exams, yet this success is not always seen as evidence of 'real' interest or 'real' expertise. (Culley, 1993, pp.152-153)

Males and females appear to be set up in unequal power relationships. Males assume greater authority than females through their interest in computer science and activities such as computer gaming. This is not to say that all males have this authority, because not all males engage in the same type of computing activities, nor that all females lack such authority.

There is an expanding body of literature that looks to explain gender differences in computer use in terms of gender-technology relations (Clegg, 2001; Clegg & Trayhurn, 2000; Jenson & Rose, 2003; Stepulevage, 2001).

My interest... is to contribute to a greater understanding of gender-technology relations in primary and secondary education by arguing for a shift in focus in gender-technology studies from the words *gender* and *technology* or *computing*, which tend to highlight categories of difference, to the word *relation* so that the social practices which help constitute difference can be highlighted... (Stepulevage, 2001, p.326)

Gender-technology relations describe the ways that males and females relate to each other around computers, the ways in which people adopt different roles and engage differently with each other and the technology. Literature relating to the nature of students' interactions with computers suggest that girls and boys take on different roles and relationships with computers and each other. Much of this literature tends to be based on observation of classes where IT is integrated in different subjects.

In the reporting of findings from observation based research relating to year 9 and 10 students in an English primary school, Beynon (1993a) observes that students' interactions with computers in mixed-gender groups tend to be defined by controller-functionary relationships, where boys dominate the keyboard and decision-making and girls act as helpers or passive onlookers. He observes that girls tend to be dominated and bossed around by the boys and describes some boys' actions as bullying. As a result of this behaviour girls are reduced to roles as functionaries – “to be ‘LOGO scribes’ and keyboard operators, mere ‘carrier outers’ of (mostly) boys’ orders... the boys assumed the decision-making and order-giving role as if it was theirs by right” (p.177). Some girls are observed to become bored and frustrated at being excluded from computing activity, with the result that they become dismissive of computing. Vale (2002) similarly describes situations where girls are marginalized and overpowered in two computer based mathematics classes. She highlights a diversity of female experiences, but signals that males tend to be positioned as insiders and the females as outsiders in a learning environment that favours competition and individual work practices. Jenson et al. (2003) describe differences in interactions between senior primary students in mixed and single-sex groups, with female instructors acting more helplessly when working with males, and often not being listened to by the boys who they are assisting.

Singh (1990, 1993, 1995) describes gender-technology relationships in Australian primary school classrooms in terms of a male norm and female other. She observes that boys' knowledge and ways of knowing are established as the desired standard, and that girls are positioned outside the normative frame. Singh describes classroom practices that marginalise girls and their computing knowledge and contends that the way computing knowledge is selected and organised in the classroom reproduces a regulative discourse of patriarchy that marginalises girls.

The pedagogic device realizing discourses of technocratic masculinity effectively manages to silence and change the voice of the feminine from computer competent to incompetent and from technologists to domestics.

...Within the pedagogic practice of computing, girls are recognized only as 'carriers of meaning': transmitters or reproducers of patriarchal knowledge. Girls are not positioned as producers of knowledge. (Singh, 1995, p.106)

Singh finds that boys tend to control power-knowledge relations in classroom computer settings and claim computer expertise, with the collusion of their teachers, who acknowledge and defer to boys' claims to expert knowledge. She asserts that the dual actions of boys and their teacher create a socially constructed fiction that establishes boys as more knowledgeable about computers and as higher order thinkers. Their behaviour is constructed as risk taking, experimental and technologically competent. In contrast, girls are positioned as inept, inactive, passive followers of rules and fearful users of computers. Girls' computer knowledge is often not recognized by the classroom teacher or other students. Even though some girls may be competent computer users in the home setting, their knowledge of computers is recontextualised in the classroom in a way that positions them as inept computer users and their contribution goes unrecognised, unvalued and unwanted. Feminine knowledge and computing preferences are construed as inferior to male knowledge. For example, adventure games and software designed for girls tend to be viewed as "deadly dull" and girls' interest in feminine adventure games may be interpreted as showing lack of imagination (Singh, 1995, p.93). However, Singh argues that the positioning of girls within a discourse of other and of boys as experts and risk takers should not be taken to infer that there is a conscious conspiracy to oppress girls. Rather, boys enter "positions within existing classroom practices and appropriated power relations to reproduce a patriarchal order" and students negotiate and shift positions within the discourses and practices of the classroom (Singh, 1993, p.51). Girls and

boys are construed as active players in the social construction and reconstruction of classroom gender relations.

In contrast to research that problematises girls in their relationships with computers, Elkjaer (1992) problematises boys and the ways in which they engage with IT. She perceives difficulties and tensions for boys as they negotiate their roles as computer users. In discussing the roles of 14 and 15 year old Danish students in a computer science environment, Elkjaer defines gender relations in the classroom in terms of a host-guest relationship. This is portrayed as particularly problematic for boys as they negotiate the host role and endeavour to appear knowledgeable and to dominate classroom activity. The girls' position as guests is seen by Elkjaer to present fewer pressures to perform, in terms of their publicly visible activity and achievement and their greater freedom to confess weakness. Her findings challenge ideas that boys' dominance in computing classrooms leads girls to develop a sense of inadequacy and learned helplessness as their confidence is undermined. She observes that girls in computer science do not think that the boys are superior in terms of subject content, and that they recognise some of the boys' activity as showing off or posing in the public sphere of the classroom – “there is no reason to believe that girls feel inferior in terms of subject content, which is clearly shown by their performance in the private sphere of learning” (p.37). Elkjaer's work challenges common understandings of gender relations in the context of computer use as simple matters of superiority and subjugation, where males act as oppressors and females are the oppressed.

The literature pertaining to gender relations in IT classes reveals that males' computing activities tend to be assumed as the norm, the desirable and natural forms of computer practice. Not that they are natural in a biologically determined fashion, but that male practice is socially constructed as the benchmark or standard. Gender-technology relationships – controller-functionary, host-guest, insider-outsider, male-other – tend to position males as knowledgeable, authoritative computer users who take dominant or controlling roles in classroom relationships and to position females as more passive computer users with lesser skills and knowledge. However, this may be an overly simplistic reading of complex and subtle classroom dynamics. In different computer contexts, not all males may hold computing authority, nor all females lack confidence or interest and have their expertise go unrecognised.

Nevertheless, the weight of literature suggests that the social construction of computing attributes greater status to the types of computing in which males tend to engage, which gives rise to a superiority mythology, in schools as in other work and life domains.

Gender identity formation

There is a growing literature that focuses on identity formation in relation to IT schooling. The ways in which people interact around and with computers are seen to contribute to the establishment of male and female identities and to reflect gender images. This literature investigates the complex ways in which masculinity and femininity is ascribed in relation to computing practices, and highlights the plurality of masculine and feminine constructions.

It has been shown that masculinity and femininity are ascribed in part through assumptions about technological competence and skill (Jenson et al., 2003; Schofield, 1995; Wajcman, 1991). Wajcman (1994) sees technology, of which computing is a manifestation, as a field where males can and do assert their masculinity.

...we need to see technology in terms of not just machines/artifacts, but the physical and mental know-how to make use of these machines. Technological know-how is a resource that gives those who possess it a degree of power, and it is largely possessed by men. Indeed it could be said that appropriating technical expertise is a defining characteristic of masculinity. Men affirm their masculinity through technical competence and posit women, by contrast, as technologically ignorant and incompetent. There is nothing 'natural' about this affinity of men with machines. It has, like gender difference itself, been developed in a social process over a long historical period in conjunction with the growth of identity...

The example of computing highlights this nexus between masculinity and technology. Here technology is seen as definitive of the activity in question. It is the archetypal case, as to be in command of the very latest technology signifies being involved in directing the future and so is a highly valued and mythologised activity. (Wajcman, 1994, p.11)

Women's alienation from computer technology is seen as a product of the historical and cultural construction of male identity and computing as masculine practice (Gill & Grint, 1995).

Computing classes provide a context for the ascription of gender. Authority and expertise in relation to computers are generally assumed to be masculine traits. Elkjaer (1992) describes computer science classes as a sphere where males struggle to assert their masculinity and to prove themselves publicly.

Boys approach computer science with an idea that the subject content is part of their gender identity, and the philosophy of science supports such an interpretation. At the same time the public stage is generally very important to boys and men. Here they find their position in the hierarchy, and as a result some of them become very dominating. This aspect of their behaviour can be described as a form of masculine occupation of the public sphere... It is threatening to the formation of boys' gender identity, if they are not allowed to take up a male stance in computer science – a subject based on masculine symbolism. Yet their behaviour is not without problems. It is painful, as it continually threatens to destroy their masculine formation of gender identity. Therefore, the private sphere of learning connected with the computer becomes a kind of 'retreat' from the public classroom. It becomes a 'free space', in which they do not have to compete with other boys to secure their position in the hierarchy. (Elkjaer, 1992, p.37)

Girls, in contrast, are purported to focus their attention on the private domain. Femininity, it is suggested, is less closely associated with displays of computer expertise.

I believe the interpretation of girls' behaviour can be based on their position as 'guests' in a sphere where boys and symbolic, masculine subject content are 'hosts'. The girls do not have any elements of their gender identity expressed in the subject content. This means that the subject demands, with which they are presented, do not challenge or threaten their gender identity. On the contrary, they are able to develop without anxiety, which... is an important aspect of the learning process. In the boys' case their gender identity and the subject content are clearly more connected. This is partly because they constantly have to secure their position in the public sphere of learning, and partly because the boys who are not competent in computer skills are busy denying their incompetence. (Elkjaer, 1992, p.37)

It is interesting to ask why we rarely hear about the boys who find it difficult to succeed in computer science, and conversely, why we rarely hear about the girls in computer science who do not constitute a problem. I believe the reason is that the gender image we have (or perhaps wish to have) of femininity and masculinity does not include incompetent and frightened boys and men, and competent and confident girls and women. But I also believe that this collective repression is reinforced, when the subject content is strongly identified with one gender – in this case with masculinity. (Elkjaer, 1992, p.38)

Elkjaer observes that some attempts by boys to maintain their masculine identity in computing studies is more performance than it is a reflection of genuinely knowledgeable positions. Thus, rather than present boys as unproblematic and naturally dominant when it comes to computers, Elkjaer presents a picture of boys' computing practices and associated behaviour as a means of negotiating gender identity.

In another example illustrating the connection between school computer use and gender identity formation, Singh (1993, 1995) highlights differences in males' and females' classroom experiences, which reflect different gendered identities amongst males and amongst females. She observes that not all the girls passively accept a marginalised position when interacting with computers in primary classrooms and that not all boys fit comfortably in the roles of experts. In fact, some boys may experience emotional distress as they attempt to

negotiate positions within male expert groups. Although the girls in her study tend to present themselves as powerless victims, some display an “aggressive, rational femininity” and the silence of some girls reflects suppressed anger (Singh, 1993, pp.55-56). Dixon (1998) describes the way in which year 9 boys in an English comprehensive school behave around computers and how this assists in the creation of gendered identities. These males adopt roles as “ordinary boys” or as “the lads” (p.152). The ordinary boys accept the school’s values for achievement and work constructively with computers at home and at school, thereby creating a command role for themselves in relation to the technology. This assists in distancing them from the lads, who, it is implied, are more rebellious and destructive and with whom the ordinary boys feel uncomfortable. Vale (2002) describes feminine identity formation in computer based classes. She observes that the outsider identity of girls takes different forms: the “outsiders”, who comprise the quiet high achieving girls who conform to passive feminine attributes of success; the “outsiders/within”, who are the girls who take risks and interact with the computer in ways that are usually associated with masculine cultures; and the “bad girls” or “others”, who resist being perceived as computer science types or as good girls who are cooperative and adopt passive feminine identities (p.215). Thus, an emerging literature suggests that multiple gender identities are negotiated in the context of classes involving the use of computers.

The literature pertaining to IT use outside of school environments supports the notion that IT is an arena where gender identities are negotiated. Kendall (2000) investigates the culture of an on-line forum, BlueSky, and describes a situation where males negotiate their masculine identities in their on-line interactions. In this situation being able to demonstrate technical knowledge and power over computer technology is an important way of displaying masculinity.

The masculinities performed on BlueSky demonstrate the convergence and interaction of several important facets of identity, including class, gender, sexuality, race, age, and relationships to technology. U.S. cultural expectations regarding technology usage converge with stereotypes concerning race and gender, resulting in a white nerd masculine identity congruent with related forms of masculinity found in computing and engineering fields. In enacting this form of masculinity BlueSky participants demonstrate both its divergence from and convergence with hegemonic masculinity. Participants recognize their lack of hegemonic status and poke fun at some aspects of hegemonic masculinity. However, they also distance themselves from women and from femininity and engage in a style of interaction congruent with hegemonic masculinity. The coupling of expectations of technological competence and this predominant interactional mode of

obnoxious bantering strengthens connections between computer technological competence and masculinities. (Kendall, 2000, p.271)

The males in BlueSky construct and adopt the masculinity of the computer nerd technophile. Trauth (2002) discusses the construction of female gender identity in the IT industry. In her examination of the socio-cultural influences on women who are members of the IT profession in Australia and New Zealand, she finds that women have very different personal histories and that different factors lead individuals to participate in the IT world in a variety of ways. However, they share a gender identity as odd-girls-out. Trauth concludes that the women's responses tend to reflect gender stereotypes. They collectively describe themselves as strong, forthright, ambitious, driven, mathematical, logical, competitive and less social than other women. These are traits that tend to be thought of as masculine and to be considered necessary for success in the IT field. However, possessing these characteristics somehow makes these female IT professionals different to other women. As IT insiders they present a differently gendered feminine identity to that of women who work outside the IT sector. Their gender identity is outside the assumed feminine norm and defined by their IT involvement.

It is suggested that the tendency for females to be positioned as others or outsiders in gender-IT relations means that they are more likely to be aware of gender as a factor in their personal computing experiences than are males.

This noticing of gender was quite common, as was the idea that being heavily involved in computers and computer games was very male. While the men in the study regretted the absence of women and felt that it would be more normal to have a better mix, gendered identity was not something they described as belonging to them. They gendered women and computers (as for boys), but appeared to take their own relationship to masculinity for granted and in ways that the women did not. The men showed no awareness of getting a job or doing computing as a man, whereas awareness of job prospects and getting trapped was articulated as a gendered experience for women. This is, of course, not surprising given the common cultural assumption of male as norm. Men may be seen in this context as having the privilege of not thinking about themselves as men. (Clegg & Trayhurn, 2000, fulltext, ¶19)

The literature, then, suggests that computer use and gender identity are symbolically intertwined. Computing competence is a constituent in masculine and feminine identity formation. It is intimated that the gendered nature of identity construction is accentuated when it is negotiated around computers, and particularly in the context of computer science, because of a strong association between technological competence and masculinity.

New perspectives

Critical perspectives in the gender and IT debate have led to the emergence of an anti-essentialist discourse, or a discourse of difference. Trauth (2002) talks of an emerging theory of individual differences, which is posed as a rejection of essentialist arguments and deepens understanding of social construction theory by exploring the way individuals experience the social shaping of gender. It is generally acknowledged that students tend to experience IT as a masculine domain and that males tend to dominate computer related activities in classrooms. However, more recent literature pertaining to gender and IT suggests that there is a situated character to gender-technology relations. Individual males and females may have quite different experiences of IT and of gender relations surrounding computer technology, depending on the context of their experiences.

Bryson and de Castell (1995) challenge the essentialist discourse that associates males and females with particular and different computing practices. They are critical of what they label as positivist/technicist views of women and computers that focus on changing female's attitudes, and are also critical of notions that associate women's ways of knowing with learning styles. By way of an alternative, they argue for a post-modernist perspective that dissolves the "impasse created by conceptual dualisms, such as male/female gender models, natural/artificial ontological systems, or for/against intellectual frameworks for thinking about educational technology" (p.35). This means focusing on and theorizing about differences in females' and in males' engagement with educational technology. It also means challenging ideas that computing technology is naturally male gendered and that the solution to inequities is the "regenderment" of women. This involves an intellectual shift so that the skills thought of as a natural male preserve come to be seen as "only apparently gendered" and "merely contingent effects of the privileged positionality of males in institutionally produced relations to technology" (pp.38-39). Clegg (2001) similarly advocates for radical and feminist scholarship as a means to challenge the way that computer science is shaped and culturally overlain with an aura of masculinity. This would involve investigations of the ways in which the gender-education-computing relationships are made and re-made in different sites, including secondary schools.

Those taking a critical perspective on gender and IT schooling do not deny the existence of differences in boys' and girls' levels of participation, attitudes towards computers or orientation to IT, nor that there are potential socio-economic consequences from the lack of participation in some types of computing related education and careers by girls and women. Rather, they seek to locate the problem of gender differences within the broad social construction of gender and computing practices, as opposed to deficiencies in girls' preferences and boys' behaviour. Attention turns to gender relations and the way these are negotiated in the context of classes involving computers, to the nature of the curriculum and the assumptions about what constitutes computing knowledge, and to the nature of social interactions in different classroom settings. There is also a move to focus on differences rather than similarities in efforts to reveal how gender-technology relations operate. Consideration is given to differences in males' and females' patterns of engagement with computer technology and with other classroom players. This is in contrast to consideration of differences between males and females, which tends to cast all males and all females as the same.

Gaps in the literature

The international literature suggests that there are persistent differences in boys' and girls' levels of computer access, the nature of their interactions with computers, their attitudes towards computers and their preferences for different applications. Girls' lack of involvement in computer science and programming is problematised. However, such observations tend to be based on original research conducted in the 1980s and early 1990s. For example, Newton and Beck's study of 143 female fifth formers in England who are interested in computing careers was conducted in 1988 (Newton & Beck, 1993). Culley's (1993) conclusions derive from a study of three London Education Authorities in the mid 1980s. The ImpactT Report (Watson, 1993) is the conclusion of a three-year project begun in 1989. Chen's work reports on research conducted in San Francisco Bay Area schools in the early 1980s (Chen, 1986). Some research is very general and doesn't distinguish clearly between school and home computer use. Also, much of the early research focuses on computing as computer science and little attention is given to different types of IT use in schools. This privileges the uses that tend to be dominated by males.

Reported experience differences partly reflect the types of experiences which are considered relevant. Thus this myth is partly an extension of the previous one. What often happens is that the hallowed name of “computing” is reserved for the particular types of computing that men choose to do, enjoy doing, and hence allocate a higher status: games, programming, playing with the latest gadgetry. Observations and questionnaires place greater emphasis on these areas. The types of activities for which women use computers are not seen as “computing”: word processing, communication, completion of projects, general organization. (Clarke, 1990, pp.54-55)

Kramer and Lehman (1990) note that much of the research on gender differences in computing fails to take into account the varying content and contexts of computing, the different topics and applications to which computers are put. Beynon and Mackay (1993) observe that there is an absence of a sociologically informed discourse and that a narrow, technology inspired discourse relating to computers in classrooms dominates in the United Kingdom. New perspectives are presented in more recent international literature, contributing to a burgeoning body of work that focuses on the nature and structure of IT schooling and the social construction of gendered identities in relation to computers. This literature looks to provide deeper understanding of gender-IT relations in schooling contexts.

The New Zealand literature relies heavily on research conducted in the 1980s and early 1990s. Vasil et al. (1987) conducted their research in the mid-1980s. The Freyberg curriculum research and development project took place over four years from 1986 to 1989 (Nolan & McKinnon, 1991). The evaluation of the Palmerston North Girls’ High School IT initiative took place in 1995 (Boyd et al., 1998). Ryba and Selby’s research relating to gender inclusiveness in tertiary courses was conducted in the early 1990s (Ryba & Selby, 1995). This literature cannot account for more recent changes in the way in which computer related schooling is presented and organised in schools, particularly for changes that may have taken place as a result of curriculum and assessment developments in the late 1990s. The effects of the implementation of the new national curriculum for technology, changes in the prescriptions for text and information management (TIM), the introduction of the National Certification in Educational Achievement (NCEA) and the formulation of computing and ICT achievement standards in the senior secondary school, are largely unknown.

The literature relating to gender and IT schooling in New Zealand focuses on issues of policy relating to access to computers and cross-curricula initiatives. Also, much of what is written in the New Zealand context is concerned with schooling practices in the younger years. I have

located very little New Zealand literature relating to specialist IT schooling at the senior secondary level. Alton Lee and Praat (2000) note that literature relating to secondary schooling tends to dwell on the extent to which interventions have been directed towards integrating information and communications technology throughout the curriculum, rather than students' participation in or experience of IT subjects. In their literature review they give little attention to technology developments in the senior secondary school, or to the specialist IT domain, perhaps because there is very little available that relates to this level and sector of secondary schooling. Their remarks relating to IT schooling in the later years of secondary schooling are restricted to comments on general participation levels and an observation that information and communication technologies are not provided as subjects for University Bursary (UB), which they think may have an effect on students' subject choices.

In the past decade in New Zealand there has been an overlapping of the curriculum traditions that support specialist IT courses. Office practice/typing courses have transformed into TIM and ICT. These and computer studies courses utilise a range of software applications, such as word processing, desktop publishing, graphics, drawing and databases (see Chapter 4). Little attention is given in New Zealand literature to the blurring of curriculum boundaries that has taken place in the last decade with regard to specialist IT schooling. Nor is much consideration given to potential changes in gender relations associated with the changing character of IT courses. The New Zealand literature contributes to an equity discourse but there is little that reflects the emergent critical discourse. This gap in the literature invites reconsideration of the gender question pertaining to students and their experiences of specialist IT subjects. Questions raised in critical international literature about the problem of girls and their lack of interest and participation in particular types of computer practices means that there is scope to re-conceptualise the gender problem relating to IT schooling at the secondary school level in New Zealand.

Summary

International and New Zealand literature describes differences in males' and females' preferences for and engagement in different types of computing activity, and differences in males' and females' attitudes towards computers and computing. It is reported that boys tend

to have greater exposure to computers, to prefer computer practices such as programming and gaming, and to have more positive attitudes towards computers; girls appear to prefer communication and production functions, such as word processing, and to be less confident and more cautious or sceptical users of computers. How one views or accounts for these gender differences depends on the discourse to which one subscribes.

Within the equity discourse, gender differences in computer uses and attitudes constitute a problem because of inequities that are seen to accrue as a result of these differences. In particular, girls are thought to be disadvantaged by their lack of involvement in computing; or, more precisely, their lack of involvement in ‘hard’ computing. This is seen to create gender inequalities as females are denied economic opportunities and influence in the IT world relative to males. The problem tends to be located with the existence of a male computer culture, which is thought to be anathema to females, and with females and their purportedly negative attitudes towards computers and computing. The solution is seen to lie in changing females’ attitudes, which it is hoped can be achieved through interventions to get females interested and involved in further IT education and IT careers.

In contrast, the critical discourse locates the ‘problem’ more broadly with the social construction of IT as a masculine domain, with socially constructed notions of what ‘counts’ as computing and with power-knowledge relations. Solutions to the ‘problem’ of gender differences in computer interests are seen to lie in broadening the scope of what constitutes computing and reconfiguring IT institutions and practices, including the form and structure of IT schooling. Also, the critical discourse challenges the tendency to generalise about the differences between boys and girls and to obscure the personal experiences of individuals. Attention is paid to the multiplicity and diversity of males’ and females’ computing activities and experiences, and to the ways in which gender-IT relations are negotiated in different settings. Variations within gender groupings and the situated nature of students’ IT experiences are highlighted. For example:

...the divisive playing field of educational technology is populated by various teams telling altogether different “true stories” having quite different settings, characters, and plots, with very different impacts for both educational outcomes and appropriate relations. But they are telling these very different stories, it is essential to note, about the very same technology. Thus it becomes important to discover which tales are told in which classrooms and how student computer use is

accordingly delimited, as much as it is important to discern what is – and dangerously so – common to all these accounts... (Bryson & de Castell, 1998, p.82)

The critical literature that has emerged in the 1990s and new millennium acknowledges the existence of historically gender stereotyped domains of IT practice and persistent differences in males' and females' preferences for different types of computing practices. However, it challenges essentialist thinking, which assumes all males and all females to have similar attitudes and experiences in relation to computers. The critical discourse, as I have framed it here, challenges taken-for-granted ideas about what counts as computing and what constitutes males' and females' experiences of computing.

New Zealand based research suggests that gender differences in New Zealand students' experiences of IT are similar to those documented in other western nations. However, the nature of specialist IT schooling in New Zealand has undergone change in recent years and has its own unique form. It is timely, then, to revisit issues of gender relations and IT schooling in New Zealand. This thesis tells the stories of girls' and boys' experiences of computers and of gender relations in specialist IT classes at the secondary school level, set in the context of a particular school and curriculum in practice. It explores ideas that are raised in the international literature pertaining to the social construction of IT and gender-IT relations.

Chapter 3 Methodological framework

This chapter describes the theoretical influences on the research design and outlines the research methodology.

Philosophical base

Positioned within a qualitative research paradigm, the interpretive frame for this thesis defies neat categorisation. I draw on what Denzin and Lincoln (1998c) would describe as constructivist-interpretive and feminist frameworks. This thesis is constructivist for its relativist ontology and subjectivist epistemology and feminist in the assumptions that real world situations make a material difference for people for reasons of gender, race and/or class. Naturalistic methodologies are features of these interpretive structures.

A relativist ontological position (on the nature and relations of being) posits that there are multiple realities, multiple experiences and interpretations of like events. Adopting a subjectivist epistemology (about the nature and grounds of knowledge) acknowledges the interaction of the knower and respondent in the co-creation of understanding. This positions the researcher and subjects as participants in the creation of meaning. Naturalistic methodologies (about how research could and should proceed) assume that research takes place in natural settings – the everyday world of the people who are the participants in the research – and the use of ethnographic methods of data collection and processing.

Theoretical perspectives

Several ideological perspectives inform the methodology I have developed. Chief amongst these are feminism, social constructionism and phenomenology.

Feminism

The empirical work being done by feminists in education spans the [methodological] gamut...
Correcting distortion and invisibility, generating new theories, exploring alternative approaches to

data generation and analysis, such work also spans the paradigms, including the “post-paradigmatic diaspora.” Regardless of paradigm, such work exemplifies that to do feminist research is to put the social construction of gender at the center of one’s inquiry... Through the questions feminism poses and the absences it locates, feminism argues the centrality of gender in the shaping of our consciousness, skills, and institutions as well as in the distribution of power and privilege. (Lather, 1992, p.91)

There are different streams or forms of feminism: liberal feminism, Marxian and socialist feminisms, radical and separatist feminisms, post-modernist feminism and post-feminism (Bensimon and Marshall, 1997; Delamont & Coffey, 1997; Knuttila, 1996; Middleton, 1993); also, the feminisms of integration, separation and re-conceptualisation (Abbott, 1991).

Feminist theorists and researchers such as Harding (1987), Lather (1992) and Stanley (1991) argue against the idea that there is a distinct feminist methodology or single best way to conduct feminist research. They contend that it is not by looking at research methods that the best features of feminist research are discerned, but that feminist research is defined by the way that problems are conceptualised. Feminist research is therefore defined by epistemological rather than methodological concerns. Haig (1999) also acknowledges that feminist research embraces diversity in research methods, but she claims that feminist methodology is characterised by common themes:

- recognition of diversity in research methods, while at the same time acknowledging that there are some common themes that tend to characterise feminist research;
- rejection of positivist orthodoxy in social science research;
- a ubiquitous concern with gender and the female world;
- challenges to the myth that science is value-free;
- adoption of liberatory methodology;
- the pursuit of non-hierarchical research relationships.

Whilst my research owes much to the varied traditions of feminism, and reflects these traditions, the deviation from a singular focus on girls and an interest in the multiplicity of girls’ and boys’ experiences distinguishes it from the earlier feminisms and is consistent with what have been described as post-structuralist (Kenway et al., 1994) or re-conceptualised (Abbott, 1991) feminist frames. The intention is to make visible the experiences of different

groups of girls and boys, rather than to give centrality to the position of girls and make only passing reference to boys' experiences as representations of a dominant, hegemonic other. Rather than ask "What about the girls?", the questions are "What are the experiences of both boys and girls?" and "What place do gender relations have in the shaping of these experiences?"

However, whether this research project can be comfortably labelled feminist research will be a matter of reader opinion. Such labelling may conjure up particular notions relating to methodology that may or may not be supported in this work. For some people, the label of feminist research implies a particular type of relationship between researcher and subjects. In this relationship the power and authority of the researcher is challenged, as are structures that marginalize women or devalue their perspectives, and the participants are actively engaged in the design of research, the analysis of information and the construction of the research product. A more traditional researcher-subject, investigator-knower relationship is fostered in the process of my research. In the process of data gathering I engage with the classroom participants, but they have little say in the research design or production of the thesis product. Regardless of how one chooses to label my research, there is an obvious debt to feminist thinking in its theoretical foundations.

Social constructionism

...the focus here [with social constructionism] is not on the meaning-making activity of the individual mind but on the collective generation of meaning as shaped by conventions of language and other social processes. (Schwandt, 1998, p.240)

Attributed to the work of Vygotsky, social constructionism describes a theoretical orientation and an interest in perceiving how meaning or understanding is developed through people's experience in social contexts. These understandings may be both distinctly personal and/or represent shared constructs. The terms social constructivism and social constructionism tend to be used interchangeably in literature. However, Burr (1995) supports the use of the term constructionism, in preference to constructivism, to avoid confusion with references to perceptual or cognitive theory relating to how people learn, which Phillips (2000) calls psychological constructivism. In the interests of consistency and clarity the term social constructionism will be used throughout this thesis to distinguish the sociological form of my work from cognitive theory.

Burbules (2000) identifies a set of propositions that help to define a social constructionist position, which are not universal and may be given different weight or significance in different accounts. Similarly Burr (1995), drawing on the work of Gergen (1973), considers that it is possible to loosely identify as social constructionist any approach that has at its foundation one or more of a set of key tenets. The following precepts help to define constructionism and are an amalgamation of these writers' ideas.

All understandings of the world partake of a social environment, even when they are formulated by individuals alone.

Knowledge is sustained by social processes as people construct knowledge and understanding through the social interactions of daily life. Social interactions, and language in particular, are therefore of particular interest. It is through language that our conceptual frameworks and understandings are expressed, reproduced and embedded in shared culture.

Our understandings are historically and culturally specific. How we understand the world, and the categories we use to define our worldly experiences, depend on where and when we live. Thus theories and explanations of social phenomena are historically and culturally bound.

Our understanding of the world and social phenomena is problematic. Ideas that there is a given nature to the world, some sort of definable or essential truth to uncover, or that our knowledge is a direct perception of reality, are contestable. Members of cultures and societies, including researchers, construct their own versions of reality. Difference and disagreement reflect the social construction of that reality.

Knowledge and social action are intertwined. Explanations for social phenomena are found in the social structures and interactions in which people engage. The focus of social constructionist research is on the dynamics of social interaction, on the processes by which people construct meaning and understandings of their world.

A social constructionist framework encourages me to focus on individual students' unique computing experiences, as illuminated in their social interactions. However, the situated nature of these experiences means that any interpretation of the meanings students attribute to their

classroom encounters is incomplete without an appreciation of the structural and social arrangements in those classrooms. Hence my effort to identify and describe the unique curriculum and pedagogical arrangements in the case study classes that provide the focus of this research. The selection of these aspects as worthy of investigation is in itself a reflection of my socially constructed understanding of what constitutes important influences in a secondary classroom, which reflects my own experience as a secondary teacher and teacher educator.

Consistent with the social constructionist interest in language as the mechanism by which people give expression to their experiences, the records relating to social interactions around boys' and girls' use of computers in specialist classes include transcripts of conversations between the classroom players – students, teacher and researcher – and observations of non-verbal responses or signals. In the presentation of this thesis, which is an interpretation of others' experiences, an effort is made to retain the voices of the players by liberally interspersing transcript excerpts in the text. In the presentation of conclusions care is taken to avoid universalities. Whilst some meanings may appear to be shared and some experiences to be held in common, hence the generation of different categories pertaining to computer experiences and gender roles (see Chapter 7), the findings of this research are situated in particular classroom environments. It would be misleading to assume that these same relationships exist in other environments in the same form, or to generalise from these situated experiences across the gamut of schooling contexts, even though similar gender-information technology (IT) relations may be discerned in other contexts.

Phenomenology

Phenomenology is the study of lived experiences and the ways we understand those experiences to develop a world view. (Marshall & Rossman, 1999, p.112)

The phenomenological tradition, deriving from the work of Husserl, is epistemologically a reality-constituting interpretive practice. As an ideology, phenomenology gives priority to lived experience over theoretical knowledge. It challenges the privileging of scientists' knowledge over the knowledge of ordinary people. As a methodology, it is the study of people's experiences of social phenomena and involves the production of in-depth descriptions of those experiences (Creswell, 1998; Jackson, 1996). Attention is paid to the

micro-contexts of daily life, to everyday social interactions and activities, in order to uncover the central or underlying meaning of human experiences of social phenomena. Examples of social phenomena include work, family, class, friendship, gender and computing practices.

There are a variety of forms to phenomenology, which reflect different philosophical and methodological positions. However, all forms share a scepticism of that which appears to be given, normal or natural. Ideas that there is an external and objective reality are rejected (Cohen & Omery, 1994; Creswell, 1998; Jackson, 1996; Ray, 1994). Phenomenological ideology underpins social constructionist research perspectives (Holstein & Gubrium, 1998). Different analytical approaches have emerged from the tenets of phenomenology, which comprise a range of interpretive practices. These include methodological phenomenology, ethnomethodology, symbolic interactionism, a conversation-analytic approach, and an interpretive (hermeneutic) strain (Cohen & Manion, 1994; Holstein & Gubrium, 1998).

The focus of this study on the lived experiences of students in specialist information technology (IT) classes and the meanings that they construct of their experiences is grounded in the tenets of interpretive phenomenology. The methodological framework that is developed is a blend of phenomenological and ethnomethodological analytical processes. According to Holstein and Gabruin (1998), ethnomethodology is distinguished by the emphasis placed on constitutive social practice and the use of naturalistic methods of study. Ethnomethodologists have a particular interest in situated talk, the recording and analysis of discourse-in-context, of the real-time details of naturally occurring conversations. They may also be interested in describing the physical activity through which order or understanding is accomplished. By implication, and in contrast, researchers adopting a phenomenological methodology are less concerned with naturalistic settings in the gathering of data. Their primary data sources may be conversations or interviews that take place away from the natural setting.

My research involves observation of classroom interactions and recording of conversations in the naturalistic settings of specialist IT classrooms. It also includes formal interviews with the participants, which are held away from the classroom environment. This mixture of data provides the basis for detailed description of students' experiences in specialist IT classes and the corresponding thematic analysis as I seek to describe and explain the experiences of

students in IT classes. The methodology used could be described as heuristic or ecological because the aim is to discover and uncover pertinent information and meaning. I consciously avoid a formulaic approach so as not to constrain the data. My analytical stance could be seen as analogous to grounded theorising, in the sense that meaning is generated from the ground up. However, a broad interpretive frame is adopted that draws on a range of methods while not being constrained by a particular method.

Positioning myself

In hermeneutical research the researcher is part of the research frame, as a participant in the research environment and as the lens through which the reality of people's experience is constituted. The lens through which I view teachers' actions and students' experiences is that of an educational professional who is grounded in the traditions of the New Zealand state schooling system. I identify as a teacher, but more particularly as a female teacher.

I have a history as a secondary school teacher and teacher educator. Of my 11 years experience as a secondary teacher, 7 years were spent as a Head of Department (HOD) in social sciences. The three schools I taught in were relatively large, ordinary schools with socially and economically mixed communities. One of these schools was a single-sex girls' school and the other two were co-educational institutions. I have 8 years experience in teacher education, focusing on the practice component of teacher education and preparing graduates in the field of social sciences for their roles as classroom practitioners. As part of my role as a teacher educator I regularly enter secondary school classrooms and observe teachers and students going about their work.

As an experienced teacher and middle manager I am cognisant of the politics and tensions in schools, both consciously and intuitively. I understand New Zealand school systems and structures. This understanding derives from my own experiences of teaching and classroom dynamics, of the way curriculum is developed in practice, and of departmental structures and the politics of secondary schools. As a female teacher I am aware of gender dynamics. I am conscious of being female in a schooling environment. I taught in a curriculum area where I did not feel that it was unusual to be a female leader. However, I looked at other curriculum areas and considered that I would be unusual if I were a leader in those domains – materials

technology and computer studies standing out for me as areas where I thought I would not have fitted so easily. It was not that I thought that I or other females couldn't, shouldn't or didn't have the ability to participate in these fields – indeed I had female colleagues who negotiated teaching and leadership roles in the computing field – but that to do so would be to break new social ground. In my experience, to be a female teacher in these areas was to be in the minority, especially in a co-educational schooling environment. Similarly, I had the notion that to be a female student in these areas was to be a female amongst males, particularly in the early years of my teaching experience and in my time as a secondary school student in a large co-educational school in the late 1970s.

As a teacher of social sciences in the late 1980s and early 1990s I was interested in the capacity of computers to support learning in subjects such as geography, history and social studies. I built activities and assignments into courses that required students to go to a computer room on occasions to use database and simulation applications. In social studies I used computers as a case study in a unit on the changing nature of work. In hindsight I would view what I did as quite rudimentary, although at the time computers were a new phenomenon in schools, there was limited access to the technology and I was constrained by my limited, albeit growing, understanding of computers. Over the decades I have used computers to support my work and daily life and I have become increasingly familiar with a range of applications as a computer user (see Chapter 1). Thus, I came to this research project as both an expert and a novice – someone experienced and knowledgeable about New Zealand secondary schools, systems and structures, but with knowledge of computer hardware and software that was constrained by my needs and prior experience as a general user rather than as a teacher or student of IT.

Research methodology

The research methodology is the inquiry strategy or design of a research project.

A strategy of inquiry comprises a bundle of skills, assumptions, and practices that researchers employ as they move from their paradigm to the empirical world. Strategies of inquiry put paradigms of interpretation into motion. At the same time, strategies of inquiry connect the researcher to specific methods of collecting and analyzing empirical materials... Research strategies implement and anchor paradigms in specific empirical sites, or in specific

methodological practices, such as making a case an object of study. (Denzin & Lincoln, 1998c, p.29)

A qualitative research strategy is employed in this research. In qualitative research the design is fluid and may alter as the study progresses. Themes emerge, questions are refined, redundant questions and strategies are jettisoned and new instruments are utilised as the researcher follows new leads and re-focuses the study.

In the selection and application of the particular methods in this study to identify and explain patterns and phenomena relating to girls' and boys' IT schooling experiences, I adopt an epistemological position that incorporates both emic (insider) and etic (outsider) perspectives. The emic is the participant's reading of the situation. The etic is the researcher's view of events, his or her abstractions and explanations (Boyle, 1994). Boyle notes that the positions taken by most ethnographers lie somewhere between the two extremes, but that individual researchers may have a preference for one of the two perspectives. My use of both observational and interview records places this research somewhere in the epistemological middle ground. Observational procedures form the etic component of this study, where I as researcher literally sit a little distant from the activity, although sometimes part of the action, and 'read' what is happening in the classroom. The search for informants' interpretations of phenomena in conversations and interviews, for representations in their own language, provides an emic component. The epistemological assumption that underpins the methodology of this research, then, is that both subject and researcher are able to inform the research, which is reflected in a multi-faceted methodology.

This thesis focuses on case studies, specifically on three specialist IT classes at Kahikatea High School (KHS), as a means of illuminating and illustrating male and female students' experiences of the IT curriculum in practice. The selection of research methods (specific means used to collect empirical information) and instruments (tools that are used in the process of information collection) establishes the boundaries of the cases, that is, how they are constrained in terms of time, events, and processes (Creswell, 1998). The methods and instruments combine to produce the field texts that constitute the data for analysis. These texts provide a series of snapshots of the human experiences. I use a range of phenomenological and ethnographic methods to generate field texts, including participant observation, audio and

video recording of classroom conversations and activity, and interviews with classroom participants. Whilst qualitative in nature, my work also draws on quantitative data as a means of describing IT curriculum trends and participation patterns in IT subjects at a national level. This sets the case study research, the qualitative heart of this thesis, in context. The methods I used and key decisions I made relating to research procedures are outlined below.

National questionnaire survey

Existing statistical sources provide historical information on enrolment numbers in IT subjects for national qualifications, published in Ministry of Education (MOE) statistical reports in New Zealand (for example, MOE 1996a, 1996b, 2001a). Updated information and enrolment figures for individual schools are also available on application to the Ministry. However, these sources do not provide detailed information on the nature of different specialist IT courses and the subtle variations in curriculum arrangements at the school level. As part of this research, a national postal questionnaire was designed and administered in the year 2000 to collect data on subject offerings and IT curriculum arrangements in New Zealand secondary schools. This provides quantitative data with which the curriculum arrangements at KHS can be compared and set in context.

The questionnaire elicits information on school demographics, the variety and nature of specialist IT courses offered, the curriculum areas that have significant roles in delivering IT education, and plans for future curriculum developments (see Appendix A). A practicing secondary school IT teacher was consulted throughout the development process and provided feedback on the wording of questions. Once it was felt that the questionnaire was close to its final shape it was subject to trial by three teachers. These teachers answered the questionnaire and provided feedback on the wording of specific questions and the accompanying guidelines. As a result of this feedback no substantive changes were made to the questionnaire and the three trial schools became the first three schools to provide a response to the postal survey.

Respondents and response rate

Questionnaires were sent to all institutions designated by the MOE as composite, secondary 7-15 and secondary 9-15 schools. These schools have students in years 9 to 13 or higher. The whole population of schools was surveyed, 446 schools in total. From these 446 schools, 198 questionnaires were returned. This is a return rate of 44.39%.

The questionnaire was administered twice. The first mail out took place in May 2000, and was addressed to the head of department (HOD) or teacher responsible for IT/Computer Studies. The initial return rate was 22.4%, not high enough to ensure that reported findings are valid and give confidence that the respondent group is a fair representation of the population. In a bid to increase the return rate, the questionnaire was sent out again to the schools that had not responded in the first round. The second mail out occurred in August and was sent to the Principal, with a request that the questionnaire be passed to the person in the school best able to answer the questions. The majority of the questionnaires were completed by HODs or by teachers in charge of computer studies (CPS) or information and communication technology (ICT) (see Table 1).

The responses include a sample of schools of different character. The majority of responses were from the type of school¹ classified as secondary 9-15 schools (58%), the school authority² classified as state or state integrated (91%), and from the school gender³ classified as co-educational (70%). All decile⁴ classifications are represented, although decile one schools provide less than half the number of responses than were received from any of the other socio economic groupings. Responding schools range in size, with the majority of responses coming from schools with rolls of 750 students or less, and include co-educational and single-sex institutions (see Table 2). Co-educational schools comprise by far the greatest

¹ Type of school defines the levels of schooling. Composite schools have primary and secondary level students. Secondary 7-15 schools begin at year 7 and secondary 9-15 schools at year 9.

² School authority defines the management and funding status of schools. Private schools are managed and funded independently, although with some state support. State schools are managed under state authority. Integrated schools are state schools but are allowed to maintain their special character, such as a religious nature.

³ School gender describes the gender mix of the student population. This can be co-educational, single-sex male or single-sex female

⁴ Decile classifications reflect the socio economic rating of school communities. A decile 10 school is assessed by the MOE to be in the top 10% on the socio economic scale. It has a wealthier family base and is likely to have a higher percentage of working, professional parents than schools of lower decile ratings.

number of returns and responses were received from twice as many girls' schools as boys' schools. However, when the proportion of responses from schools represented in each gender category is compared with national statistics, it emerges that co-educational schools are under-represented and that single-sex girls' schools are over-represented in the questionnaire returns. Notwithstanding this difference, the percentage of schools of different type and authority in the sample group is very similar to the proportions in the national school population.

One of the challenges in the administration of the questionnaire was getting it to the person in a school who was best able to answer the questions. Schools have different administrative arrangements for the specialist IT curriculum, depending on the internal departmental structures of the school and management responsibilities. Some schools maintain separate computing, IT and/or commerce departments, some have combined departments from different IT traditions, and some are organised on faculty lines. People from various curriculum backgrounds take responsibility for different aspects of IT education and network management. Thus, sending the questionnaire to the Head of IT/Computer Studies was no guarantee that it would be received by a person with an overview of IT arrangements in the school. Also, whoever received the questionnaire might need to seek information from others in order to answer the questions. This would be likely to take considerably more time than the estimated thirty minutes in the questionnaire guidelines and present a greater risk of the questionnaire being lost or overlooked. It might also put teachers off answering the questionnaire as it could be seen as a nuisance task. Responses from several schools confirmed the suspicion that postal questionnaires are seen as an unwelcome addition to teachers' workloads. Fourteen schools returned the questionnaire unanswered or sent a message declining the invitation to participate in the survey. Of the five schools that gave an explanation, one felt the questionnaire was irrelevant to their situation, one had a new HOD who felt he was unable to answer the questions and the other three expressed agitation at being constantly bombarded with IT surveys and gave time and workload concerns as reasons for returning the questionnaire unanswered. However, by following up on the initial mail out with a questionnaire addressed to Principals some of the difficulties in eliciting responses from schools were reduced. This strategy was successful in nearly doubling the response rate to the questionnaire. The responses represent a snapshot of IT arrangements in schools between May and December 2000.

Table 1: Respondents by position and school type

Position	School type			Total
	Composite	Secondary 7-15	Secondary 9-15	
Assistant Principal/Deputy Principal	5	7	2	14
Principal	8		7	15
School Administrator/Secretary	3			3
Timetabler			1	1
Computer Manager*		2	7	9
Teacher	5		1	6
Teacher in Charge of ICT	7	6	17	30
Head of Department Computing or ICT	17	23	76	116
Nil return	1		3	4
Total	46	38	114	198

* Includes Computer Manager or Administrator, Director of Resources, Faculty Manager, Chairperson ICT Management Committee, Executive Director ICT

Table 2: Responding schools by authority, gender and size

School Authority	Gender	Roll							Total
		0-250	251-500	501-750	751-1000	1001-1250	1251-1500	1501+	
Integrated	co-ed	10	4		1				15
	ss boys	2	3	2	1		1		9
	ss girls	5	8	6	2				21
	Total	17	15	8	4		1		45
Private	co-ed	8	2	1	1				12
	ss boys			1					1
	ss girls			2		1	1		4
	Total	8	2	4	1	1	1		17
State	co-ed	22	27	27	12	13	6	4	111
	ss boys			2	4		3	1	10
	ss girls		1	2	5	3	3	1	15
	Total	22	28	31	21	16	12	6	136
Total		47	45	43	26	17	14	6	198

Questionnaire processing

The details from the questionnaires were entered in an Excel spreadsheet. Pivot tables were used to check the accuracy of data and any blanks or inconsistent records were checked against the hard copy questionnaire responses and corrected where inaccuracies were detected. A coding system was devised to represent responses of a similar nature. This data massaging process threw up inconsistencies in the inputting of the data and meant that a large proportion of the entries were checked against the original returns, thus ensuring that the spreadsheet information was an accurate data record.

Additional demographic data was sought from the MOE. Information on school decile ratings and roll numbers was added to the database. Some respondents did not provide demographic information on school gender and authority and Ministry records were used to fill in these gaps. Pivot tables were used to provide counts relating to different variables and to generate

data summaries relating to different combinations of variables. These are the basis of the tables presented in Chapter 4 (see Tables 7, 10, 11 and 12).

Case studies

...a case study is an exploration of a “bounded system” or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context. This *bounded system* is bounded by time and place, and it is the *case* being studied – a program, an event, an activity, or individuals. (Creswell, 1998, p.61)

Case studies provide an opportunity to investigate in depth the objects or phenomena of interest. The reasons for undertaking case study based research vary, from an intrinsic interest in the story of a single case to the joint study of a number of cases in order to investigate a general phenomenon, population or social condition. Case studies can be used for exploratory, descriptive and/or explanatory purposes. Multiple case studies are employed where a researcher wants to achieve a balance between in-depth investigation of individual cases and broader examination of a range of possible situations (Creswell, 1998; Schofield, 1993; Stake, 1998; Yin, 1994). The specific case study structure and research procedures that underpin the data collection for this thesis are described below.

Case study structure

Multiple case studies provide the structural foundation of my research into the phenomenon of students’ experiences of specialist IT classes at secondary school level (see Table 3). This thesis may be described as a collective case study, with each of the contributory classes comprising instrumental case studies (Stake, 1998). Focusing on several classes allows me to explore the general phenomenon of students’ experience, while at the same time maintaining the integrity of the cases by recognising the uniqueness of setting and context in individual classes. Within each class, a number of students are the focus of attention. They constitute what Yin (1994) calls embedded case studies, or sub-units of analysis. They might also be called nested cases.

All three IT case study classes are located within the same school, KHS. Thus the investigation is restricted to a particular school context and bounded by the institutional and

Table 3: Case study structure

Instrumental cases <i>Classes</i>	<i>Teacher</i>	Embedded cases <i>Class participants</i>	
		<i>Girls</i>	<i>Boys</i>
12CPS (Year 12 Computer Studies)	Mr Lucas	Joanna Kathy Lisa Xiao-hong	Carl Mason Scott Ben
12TIM (Year 12 Text and Information Management)	Mrs Keall	Angela Fiona Emma Gini Beth Winifred	
10TIM (Year 10 Text and Information Management)	Mrs Nugent	Harriet Vicky Susan Marie	Rawiri Luke Matthew Nicholas

curriculum arrangements of that school. By focusing on one school, greater depth of investigation and analysis is possible than if the research were spread over a broader range of institutions. The examination of multiple cases (specialist IT classes) at KHS allows broader investigation of the phenomenon of student experience than would be possible with a single case (class). Also, the examination of particular student sub-units provides more in-depth insight into students' experiences of the enacted curricula in a single specialist computing class than would be obtained from macro level class observation.

How were the cases selected for this research? Basically the class cases were selected to provide examples of different types of specialist computing classes, with different teachers, different social and gender dynamics, and representing different specialist IT curriculum domains and stages of schooling. Classes that correspond to these conditions were found at KHS (see Table 4).

Table 4: Characteristics of case study classes

Class	Curriculum domain	Age of students (approx.)	Gender of students	Gender of teacher
12CPS	Computer studies	16 years	mixed	male
12TIM	Business studies	16 years	all-female	female
10TIM	Business studies	14 years	mixed	female

Kahikatea High School is a large urban, co-educational, secondary school from the middle decile range. The school has not received exceptional levels of funding for IT, or been the

subject of extraordinary government or private IT interventions. It can therefore be viewed as a fairly typical or mainstream secondary school environment in relation to IT schooling.

The decision to confine the cases to one school was made for methodological and pragmatic reasons. There is a methodological advantage in locating all the case study classes within a single school. By spending time in one school I could get to know the people and the culture of the school better than if I were working in different sites. Locating the case studies in several schools would present greater challenges when trying to identify institutional factors relating to school culture that might influence students' experiences and when interpreting those experiences. Also, the time and resource constraints that confront a single investigator mean that it is advantageous to work in one school. I am interested in presenting a detailed picture of the experiences of students in different specialist computing classes, with the intention of identifying the range and subtleties of experience, rather than generalizing for all possible school contexts. Depth is achieved through the investigation of the embedded student cases in different classes within a single school.

Within each case study class, the student cases are selected on the basis of gender and social arrangements. This is consistent with the constructionist view that students' classroom experiences are a function of social context. Equal numbers of girls and boys are selected for study in the co-educational classes. The total number of students is limited to eight in 12CPS and 10TIM, this being thought sufficient to provide a range of cases within the two gender groupings. In the 12TIM class, the total number of cases is reduced to six, given that this is a single-sex class. The students who comprise the embedded cases are observed to belong to different social groups and to sit in different parts of the classroom at the beginning of the data collection period, although some change seating location in the course of the year. Whilst all the embedded cases are the focus of classroom observation on at least two occasions during the year, not all the embedded cases may receive the same attention in the data analysis and presentation, depending on the information gleaned and the pertinence of specific cases to themes that emerge in the analysis.

Negotiating the process

Negotiating access

Having gained ethical approval for the research from the university ethics committee I turned my attention to negotiating access to a school. Permission was gained from the Principal of KHS to conduct research in the school, involving selected teachers and classes. The Principal was willing for the research to be conducted at KHS but he expressed concern about the workload of teachers, implying that some teachers might feel that involvement in the research project would be a burden. He indicated that it would be over to the individual teachers whether or not they wished to participate. Negotiations then proceeded with the Head of Computer Studies, who also had a role in the senior administration of the school. I consider that it was his personal involvement in the research and his goodwill that enabled the research to proceed. He assisted in negotiating access to different classes and the involvement of teachers from the different IT traditions and curriculum domains at KHS. When I met with individual teachers I explained the purpose of the research, described the methods of data collection and the ethical procedures, and gave them an indication of the likely timeframe for my involvement with their classes. I was then able to embark on a trial of data collection methods and instruments and the data collection proper.

Ethical considerations

Punch (1998) notes that the nature of field research is dependent on the researcher's perception of the field situation at any one time, which is shaped by the personality of the researcher and by the nature of that being researched. Ethical dilemmas have to be worked out spontaneously and issues of consent, deception, privacy and confidentiality, trust and betrayal, are situationally decided. Several such factors had to be negotiated during data collection as I made on-the-spot judgements and weighed my personal research interests against the rights of the participants. For example, although official permission was given for me to be present in IT classes at KHS, by the Principal and the three teachers involved, this might not account for the personal feelings of individual students who are covered *en masse* in the official permission. Although the class teachers were willing to have an unfamiliar researcher in the room, some students might be less than comfortable with this arrangement. Some of the data collection procedures, including the audio recording of individual students' conversations and

video recording of classroom activity, might be construed as invasive and unwelcome. This was indeed the case and there were instances when I needed to negotiate the inclusion, or exclusion, of individuals from the research in the course of my work in classrooms.

In my initial meeting with each of the case study classes the students were given a letter where I introduced myself and gave a brief outline of the research project. I also spoke to the students at the beginning of their lesson, explaining who I was and what I would be doing in their class, and signalled that there would be recording equipment present. Students were told that if they were uncomfortable with this they could tell their teacher or me privately and that, although their images or voices might appear on the tapes, I would not use any quotes from them in the writing up of the research if that was their wish. I also stressed to the students and teachers that their privacy is important and that any references to individuals in the reporting process would be under pseudonyms. In addition, I explained to students that I would hear some private conversations relating to their social lives, but that I would maintain their privacy; disclosure of personal information would only occur if it was a matter of their own or someone else's safety. At this initial meeting I sat in on the class for the lesson but I didn't set up any recording equipment.

I received no notification from teachers or students that anyone did not want to be involved in the research. However, there were several instances when I became aware of unusual behaviour on the part of students. This behaviour could be variously interpreted as signals of discomfort and reluctance to be the focus of attention or as students having fun for the microphone and seeking attention. One student's negative reaction to the recording equipment resulted in a change of plan and her exclusion from the embedded cases in 12CPS. This girl, Zara, entered the room and chose to sit away from her usual seat, perhaps because she noticed the microphone set up near her place. Her demeanour, scowling at the camera and apparent reconsideration of seating position, suggested that she did not want to be part of the research (ob 6/4/01)⁵. I did not persist to make her one of the student cases. Instead I focused the observations on another girl, Lisa, who sat near the microphone in this lesson. In contrast and on a different occasion with the same class, Ben expressed reluctance to have the microphone near him. I talked to him and coaxed him into participating (ob 17/9/01). This was the last of

⁵ See the Abbreviations section for coding relating to field text citations.

my observations with this group and Ben was one of my selected male participants, in whom I had already invested observation time. His non-participation would have been inconvenient and involve unplanned repeat visits to observe a newly selected male case. On other occasions Ben hadn't seemed worried by the observation procedures and equipment. In this situation the way I balanced conflicting interests led me to persist in maintaining Ben as a research participant. Thus, my responses to students' apparent discomfort with the observation process depended on what I sensed to be the degree and nature of their reactions and how critical I thought the individual was to the research at that stage of the research process.

Participants in the study were told that they could view conversation and interview materials relating to them on request. However, sensing that students might be reluctant to ask for any transcripts, I copied the interview transcripts and gave these to the participating students after the event. Likewise, copies of transcripts involving the teachers were available to the teachers on request. This was really a trust building activity, rather than an attempt to glean the participants' responses to the texts or input into the analysis. I gave participants access to their records, if they wanted them, but not the opportunity to modify those records. This is because I wanted their initial reactions and responses, rather than a version that might be altered to appear more politically correct or acceptable.

Ethical considerations mean that documents relating to course outlines are not included in the Appendices of this thesis. Mrs Keall asked me not to share her 12TIM course outline with anyone else, a request that I respect. She implied concern that her intellectual property be protected. I feel ethically bound to maintain the confidentiality of documents relating to all courses under Mrs Keall's jurisdiction, which includes 10TIM. Consequently, teachers' course materials are not reproduced here, although curriculum structures and course content are described and discussed as it pertains to the focusing questions.

Trial of research instruments

Late in the 2000 school year I spent time in three classes at KHS, at years 9, 12 and 13, trialling various research instruments, such as observation forms and audio and video recording equipment. In addition, I recorded interviews with three teachers, two of whom were involved in the data collection process the following year, where we discussed how the

curriculum is organised in the CPS and TIM courses and their observations about students' computing interests. For practical and financial reasons I decided to work with small, fixed, condenser microphones to capture students' conversations. A microphone was placed near the student who was the focus of a particular observation session and connected by a long cord to a tape recorder. The equipment was set up at the beginning of the observation lessons, usually before the students arrived at class. There were some difficulties with the quality of the sound recorded this way, especially if there was a lot of background noise or if students spoke very quietly. However, trial and error with different recorders and microphones meant that the most effective recording arrangements were decided prior to the formal lesson observations beginning the following year. The means of recording teachers' conversations was also tested, with them wearing lapel microphones attached to a microcassette recorder, which they wore around their necks or in a pocket. This worked surprisingly well and provided an economic alternative to radio microphones. To record classroom activity a video was set up at the back of the room, on a tripod, and angled to catch as much of the classroom activity as possible. The trial revealed that it was never possible to see the whole room and all the students at the same time using a single video camera, given the size, shape and arrangement of computers in the classrooms. However, the single camera was effective in focusing on whole class activity and teacher movement.

The trial of recording equipment and methods sensitised me to potential problems and made me aware of the importance of back-up systems to allow cross checking of audio records, to supplement one source and to allow verification from another if a recording was poor. Being aware of the limitations of the student microphones meant that I made a point of noting spoken phrases and the topics of conversation at various intervals in the classroom observation records. These are cross-referenced with the audio record. Teacher-student conversations recorded on the teacher microphone are verified and supplemented by the conversations captured on the student microphones, and *vice versa*. The video recording enables conversations to be set in the context of whole class activity. Also, in situations where an audio recording is damaged, the video recording provides supplementary audio material.

Data collection timeframe

The data collection for all three case study classes took place in 2001. Data gathering was staggered, with observations in 10TIM and 12CPS initiated early in the school year and a second observation round undertaken later in the year, and the observations with 12TIM taking place in the middle of the year (see Table 5). Having a second round of classroom observations for 12CPS and 10TIM meant that the classes were observed while students were working on different topics. A conscious decision was made to hold the second round of observations for 12CPS during the programming unit, which is part of the 12CPS course but not of the 12TIM course at KHS. Observations with the 12TIM class also took place during different topics, but in a more compressed time frame. It was anticipated that unexpected events, such as equipment failure or user error, would create problems – rightly so in several instances – but having multiple observations of individual students provided backup and supplementary data. Interviews were conducted with the students towards the end of the year and with classroom teachers at convenient times during the year (see Table 5).

Table 5: Data collection diary 2001

Month	Classroom observations	Unit of work	Teacher interviews	Student interviews
March	12CPS round one	Word processing	Mr Lucas Mrs Nugent	
April	12CPS round one	Word processing, database		
	10TIM round one	Word processing		
May	12CPS round one	Database, spreadsheet	Mr Lucas	
	10TIM round one	Word processing		
June	12TIM	Database, research		
August	12CPS round two	Programming	Mrs Keall	Angela, Fiona, Gini, Emma, Winifred, Beth
	10TIM round two	Spreadsheet, word processing, composition		
September	12CPS round two	Programming		Mason, Carl, Kathy, Lisa
	10TIM round two	Composition		
October				Ben, Scott, Xiao-hong, Joanna, Matthew, Nicholas, Rawiri, Luke
November			Mr Lucas Mrs Nugent	Harriet, Vicky, Susan, Marie

Methods and instruments

A variety of ethnographic methods of data collection and management are employed that provide records of social life in specialist IT classes at KHS. These records constitute accounts of social episodes (Cohen & Manion, 1994). Clandinin and Connelly (1998) would call these data records field texts, meaning the written, aural or visual copy that is created to represent aspects of field experience. The field texts generated in this research form the basis of the rich description of students' experiences of IT classes and consideration of gender relations operating in the classroom settings. They also constitute the first stage in the data analysis process, where decisions are made about what sort of information is useful and what actions or interactions warrant inclusion in the records.

In the selection and application of different research methods in this study I assume that language and talk are important tools for constructing and representing meaning and for describing experience. Hence the emphasis given to audio taped conversational and interview records in the construction of field texts. However, experience can also be given expression in physical action, gesture and reaction. Video recordings capture general classroom activity for the data record and the focused observation records for individual students include notes of non-verbal communications or responses. The field texts are constructed to describe both what the subjects do and say in the course of their everyday classroom interactions with the computer and with other classroom participants.

Participant observation

My role in the data collection phase is that of a participant observer. Participant observation immerses a researcher for a prolonged period in the life of a group of people in order to discern their habits and thoughts and to uncover the social structures that bind them. He or she embarks on systematic observations of events, actions, interactions and relationships in a naturalistic setting (Mason, 1996; Punch, 1998). I participated in the life of each of the three classes at KHS over a period of a month or more and conducted systematic observations in the naturalistic setting of the classrooms. There was a dual focus to these observations – the experience of a particular student, selected as the focus of study for a session, and broader classroom interactions and activity.

The following field texts were generated from each observation session:

Observation schedule – notes describing the chosen student's computer use and social interaction;

Student audio recording – taped and transcribed conversations of the student who is the focus of observation;

Teacher audio recording – taped and transcribed teacher conversations;

Video recording – real-time pictures of classroom activity;

Research journal – notes and questions relating to the activities in the classroom, the researcher's interactions with the participants, and the researcher's interpretation of events.

Various practical difficulties were encountered in the generation of field texts from participant observation. For example, at times it proved difficult to be able to see what a student was doing, given the layout of the classrooms and the orientation of students towards their computer screens. Sometimes I was able to position myself alongside the students, but at other times I was necessarily more distant, so as not to impede classroom activity, and consequently had a more restricted view. The student audio recordings proved the least reliable of the data sources. However, as already mentioned, observation notes gave an indication of the nature of a conversation even when the audio recording was lost and sometimes the same conversation was recorded on the teacher audio tape. Composite observation records were constructed from the variety of field texts available, which describe the activities in which individual students engage, conversation points and references to associated audio and visual texts (see Appendix B).

Qualitative interviews

Qualitative, semi-structured interviews with individual teachers and with small groups (pairs) of students are utilised in this research (see Appendices D and E). The focus on the phenomena of lived classroom experiences and gender relations make qualitative interviews an appropriate mode of data collection. Qualitative interviews focus on the lived world of the subjects and their relation to it and are a means to explore themes of interest to both parties in

the discussion. They help a researcher to understand the meanings of the central themes in the lives of the participants. The aim is to get precise and detailed descriptions of specific situations and experiences from a participant's world. The interviewer works to obtain rich and nuanced descriptions, which is commonly achieved by adopting a position of deliberate naïvety. Qualitative interviews are creative works, open to change of direction as the interviewer has to make on-the-spot decisions about which ideas to pursue further and which to disregard (Kvale, 1996; Mason, 1996). Holstein and Gubrium (1997) talk about interviews as “interpretively active, meaning-making occasions” where the data is “unavoidably collaborative” (p.114). The advantage of a more informal, qualitative interview is its flexibility and the capacity to delve into themes and respond to emerging ideas (Cohen & Manion, 1994).

Inherent in qualitative interviewing is a tension between a desire to obtain comparable information and to elicit deep explanations, a tension from which this research is not immune. The use of a fairly detailed interview schedule for student interviews (see Appendix E) reflects a desire for consistency and ability to compare responses to similar questions. However, the schedule is applied in a flexible manner. All themes in the schedule are addressed during the interviews, but questions are adjusted and others added in the course of the interviews to obtain elaboration and clarification of discussion points, depending on the direction taken by participants. The varied length of different interviews with students and teachers reflects the active role taken by myself as the interviewer and the conversational nature of the interviews. The interviews often return to earlier points, circling back on ideas and providing elaboration, partly as a result of the order of questions in the schedule and partly as a function of the conversational nature of the interactions. Follow-up interviews were conducted with some participants in order to complete the interview schedule or pursue questions that arose in the course of classroom observations.

The decision to interview the students in pairs was made presupposing that a small group environment would stimulate discussion or conversation and that some students would be more comfortable talking in this situation than in a one-on-one interview with an adult who is a relative stranger. According to Cohen (1994) and Glesne (1999), group interviews may embolden children to contribute, provide opportunities for discussion and elicit a wide range

of responses than would otherwise be the case, although they may also discourage individuals from discussing personal matters and constrain conversations with individuals. In deciding the particular pairings of the students for interview I assessed which students I thought would be most comfortable and open with each other, based on my observations of their interactions and behaviour in class. I will never know what it is that students chose not to say in the interviews, but several of the students were disarmingly frank in their comments and did not appear to be constrained by the group environment. My experience is that the quieter students tended to defer to their partner in the interviews, but that they provided their own interpretations when prompted. One student, Xiao-hong, for whom English is her second language, tended to concur with her peer's views in the interview and at times struggled to express her ideas in English. However, her partner, Joanna, was sometimes able to articulate for Xiao-hong ideas that Xiao-hong found difficult to communicate (si 30/10/01). Sometimes in student interviews the ideas that emerged were clearly agreed or negotiated responses. One person would express an opinion, which was reiterated or claimed by the other later on. For example, Carl and Mason both described frustration at not getting enough teacher time, but at different stages in the interview and in response to different questions (si 14/9/01). In such situations it was not that a student was being disingenuous, rather that a student's peer might say something that he or she hadn't thought of, but with which he or she agreed, and the student proceeded to claim the idea for his or herself at a later juncture. Often it was the student-student debate around an idea that made the meaning clear.

Documentary records

Documentary records supplement the observation and interview field texts. They aid the description of the curriculum structures and content for different specialist IT courses at KHS. Documentary field texts include:

Schemes of work – the course outlines for specific IT courses at different year levels;

Activity instructions – the worksheets and sections from text books that describe the computing exercises in which students engage during the observation lessons;

Course information booklets – the information given to students that describes the courses available to students at KHS, from which they make their subject selections.

Trustworthiness and credibility

In a qualitative paradigm, judgements about the quality of work are based on criteria such as credibility, transferability, dependability and confirmability. Positivist concepts of validity and reliability take on their common meanings, rather than the narrow interpretations associated with tests and the measuring instruments of formal science. Data that is considered to be valid is that which is well grounded and supportable. Reliable data is dependable data. Significance is defined by the meaningfulness or importance of the findings, rather than statistical boundaries (Denzin & Lincoln, 1998c; Polkinghorne, 1988). Qualitative researchers strive to fairly represent the experiences of research participants as they are socially constructed. Attention is paid to how meaning is constructed and the circumstances of this construction (Holstein & Gubrium, 1997). It is the very unpredictability and uniqueness of the social contexts that is of interest to qualitative researchers. They seek deep understanding of social events and situations rather than identification of immutable, predictable truth. Kvale (1996) argues that validity in qualitative research is a concept of quality craftsmanship. With a shift away from a quest for absolute and certain knowledge comes a shift towards the idea that validity corresponds with defensible knowledge. Validity in qualitative research comes from examining sources for falsification; to validate is to check and to question the data, interpretations of events and a researcher's perspectives on the subject, and to theorise about the nature of the phenomena under investigation. The desired outcome is a sound, justifiable and convincing argument. Concepts of quality craftsmanship and trustworthiness ensure the integrity of qualitative research.

Two methodological strategies that are commonly used in qualitative work to maintain the credibility and trustworthiness of the process and of the product are triangulation and reflexivity. The way in which the field texts are treated also contributes to the trustworthiness of the data and of the information gathering and analytical processes. The application of these strategies in this research is outlined below.

Triangulation

Triangulation, as it is commonly understood and used, is the practice of using multiple information sources or methods of data collection and/or analysis as a means of challenging or

confirming the legitimacy of findings. The multiple method approach provides a broader perspective on the complexities of social interactions and helps to reduce bias that may result from use of a single research method or source. It is an appropriate verification method when a holistic view of educational issues is sought and when investigating complex phenomena (Cohen, Manion, & Morrison, 2000; Creswell, 1998; Fetterman, 1998). However, some commentators (for example, Coffey & Atkinson, 1996) caution against the indiscriminate use of large numbers of methods or sources in the assumption that this will produce a better result. They endorse the thoughtful use of a range of methods, but a limited range, to explore different facets of data and produce a sensitive appreciation of complexity and variety in the data.

I achieve methodological triangulation in this research in two ways. The first of these is the use of the same data collection methods on different occasions, such as the audio and video recording of teacher conversations and classroom activity over the course of the observation period. The second is the use of different methods in relation to individual informants. When focusing on individual students I record their experiences in a variety of ways – observation of interactions, audio recording of conversations, and engagement in interviews. The resulting field texts provide sources of information that contribute to the overall picture and help to verify or challenge impressions gleaned from other data sources relating to individual students' experiences of specialist IT classes.

Situational triangulation is evident in the multi-level, multiple subject research design that is the basis of this thesis. The research questions focus on the phenomena of students' experiences of specialist IT classes and gender relations. To help describe these phenomena attention is given to the curriculum context, to curriculum structures at the school and class levels. The inclusion of several class case studies and multiple embedded student cases presents opportunities to compare and question the findings that emerge in any one setting or situation.

Reflexivity

Reflexivity is both a state of awareness and a practice. It means that a researcher views himself or herself as unavoidably part of the world that he or she is investigating and as

affected by that world (Boyle, 1994; Holliday, 2002; Muecke, 1994). As a practice, reflexivity involves a researcher in reflection about his or her worldview, experiences and preconceived ideas, which have a bearing on the way events and interactions play out and are interpreted in the research setting. A researcher acknowledges his or her role as an instrument or a catalyst in the research process. Reflexive practice can take a variety of forms. For example, Marcus (1998) talks of self-critique as “baseline” reflexivity (p.395). Strauss and Corbin (1998) discuss an analytical technique they call “waving the red flag” (p.97), that is, looking for indicators of bias, assumptions and beliefs in researchers’ and participants’ responses that may intrude into the analysis of data. In the context of interview based research, Holstein and Gubrium (1997) describe the writing up of interview data as an “analytically active enterprise” whereby the analyst “describes the complex discursive activities through which respondents produce meaning”, the aim being to clarify how meanings are “constituted both in relation to, and within, the interview environment” (p.127). Reflexivity is construed as a positive feature of the qualitative research process. It acknowledges the interaction between researchers and participants in the research setting and the positive role that an investigator may have as a catalyst in the research process, rather than engaging the researcher in fruitless or impossible efforts to remove the researcher effect (Holliday, 2002).

I reflect in general on my reflexive practice and my relationship with the research participants in specialist IT classes at KHS in this section. Also, specific issues pertaining to researcher-participant relations are illuminated in the data analysis and discussion chapters, as they emerge as possible influences on the creation or interpretation of the field texts and the ideas that are being presented and debated in this thesis. My aim is to acknowledge the interactions and discursive practices that may have a bearing on the findings, as and where these emerge and are pertinent, without cluttering the commentary with constant reflection on researcher-participant relations.

In an effort to address my own role and position in the research process I engaged in several reflexive practices, consciously and purposefully reflecting on the research process. Specifically, I kept a journal in which I described and interpreted events in the classroom after each observation session, including observations of researcher effect. This informs my commentary on researcher-participant relations and my interpretation and analysis of field

texts. In another reflexive strategy, early in the research process I wrote about my own background, teaching and research experience, and about my views on gender and school computing. By doing this I became aware of my own beliefs and preconceived ideas relating to the phenomena under investigation, and how my ideas were being challenged as the research progressed. This also enabled me to be more critical and questioning when interpreting events in the classroom, by being wary of assumptions and bias in my own worldview. In particular I was compelled to challenge my simplistic tendency to aggregate girls and boys in similar groups, assuming similar experiences for all girls and all boys. I came to question the essentialism of my perspective.

What is the nature of researcher-participant relations in the specialist IT classes that are the basis of this study? As already discussed, I engaged in participant observation in this research. In work of this nature a researcher is involved in the life of the group, but he or she is not necessarily a member of the group (Mason, 1996; Punch, 1998). As a researcher I became part of the classroom scene or culture in the specialist classes at KHS, but I was not a member of the student peer groups. Also, I had a relationship or connection with the participating teachers based on common teaching experience, but I was not one of them. I was not a colleague on the staff of KHS. Nevertheless, my role and experience as an educator influenced my relationships with the participating teachers and students. I interacted with participants in a teacher-like manner – conversing with participants in classes, sharing experiences, and on occasions being consulted by students and assisting them with their work.

Also, as previously mentioned, my academic and professional background placed me in positions of both novice and expert in my role as researcher and in my relationships with the participating teachers. I was very familiar with secondary schooling and curriculum structures and the culture of New Zealand secondary classrooms. However, I did not have personal teaching or administration experience in respect of specialist IT courses. Thus, whilst I had credibility as an experienced teaching professional, I was a novice in that particular curriculum environment. By virtue of conducting research in the field I was assumed to be an expert and someone from the field. Both Mrs Keall and Mrs Nugent appeared to be surprised when I told them I was not an IT teacher, although they did not make an issue of this difference. On occasions they sought my opinions on how their curriculum arrangements compared with

other schools, attributing to me the role of a knowledgeable person. In contrast, Mr Lucas and I had a common bond in our backgrounds as social science teachers, something that I made known to him from early in our acquaintance. Also, we shared similar experiences in the manner of our personal introductions to computing and experiences as teachers managing the introduction of computers in the context of social science classes. I felt that I was accepted as a professional colleague by the teachers at KHS, due to my teaching background and supposed expertise in research, but that my not being from the field, or from the school, meant that I was also inevitably an outsider.

What about my relationships with the students in the specialist IT classes? During the classroom observations I purposely tried to take a back seat, literally and metaphorically speaking, and to restrict my interactions with students. The reason for this is that the focus of the research is students' experiences in IT classrooms, which are revealed through observation of their interactions with class members, their teachers and computers. I felt that this would be obscured with persistent and invasive interruptions from me. Some might argue for researchers taking a stance of active inquiry, interrogating participants with questions about what they are doing to help distinguish the usual from the unusual in the data (for example, Morse, 1994). However, I judged the intensive use of such strategies to be inappropriate in the classroom observation component of this research, given the intention to maintain a naturalistic setting and to keep class operations as normal as possible within the methodological constraints of the study. Nevertheless, in the course of classroom observations I interacted with students, and they interacted with me, in social banter and discussion about the tasks at hand. As a participant in the classroom I was inevitably drawn into classroom conversations and interactions. I tried, though, to minimise interruptions to individuals as they went about their work.

I detected some evidence of altered student behaviour that was attributable to my presence in the case study classrooms, particularly in response to the proximity of recording equipment. For example, Ben in 12CPS displayed reluctance to have his conversations recorded (on 17/9/01). He asked "Does it [the microphone] need to be here?" but he consented to his conversations being taped "in the interests of research" (his words). In the course of the lesson he placed the earpiece from his personal stereo by the microphone for a short time. I

interpreted this as a mildly subversive action. Ben showed that he could spoil the conversation record if he chose to. Similarly, but in a more extreme case, Lester scuttled an observation session by playing music CDs and singing into the microphone throughout the lesson, to his and others' amusement (ob 6/4/01). However, he seemed to be fascinated by the microphone and looked to it for entertainment. In a later lesson he asked what his singing sounded like (ob 27/4/01). Another boy, Kevin, wanted to use the camera to go around videoing people in the class and Ben asked for the microphone to be placed near him. Neither request was granted. On other occasions, one or more students reacted to the camera by smiling, pulling faces or talking to the camera as they entered or left the room. In one instance, while waiting outside the 10TIM classroom with the students, I asked Tom if he liked having the microphone near him and whether he thought his behaviour was better or worse when the microphone was present (ob 12/9/01). He replied that it was being like being on a talk show and that his behaviour was worse. In contrast, Matthew didn't object to having the microphone nearby, but his teacher noted that his misbehaviour was "a first" (ob 7/9/01), meaning that this was the first time she noticed someone behaving out-of-character for the microphone. When questioned about this later Matthew indicated that he was uncomfortable at the invasion of his privacy (si 21/11/01). Thus, some of the boys' out-of-character behaviour appeared to be a reaction to the novelty of the situation and/or an experiment in performing for recording equipment for their own entertainment. For others it was an expression of discomfort or anxiety at the presence of recording paraphernalia.

Students showed that they were aware of whether and how their behaviour changed when they were being observed. At the conclusion of their interviews students were specifically asked whether my presence and that of the recording equipment altered their behaviour in any way. Some denied that there was an effect or signalled that the influence was minimal. Others claimed an effect, most commonly of constrained speech and a reluctance to discuss social matters. For some students the observation procedures were intimidating; for others they were a source of enjoyment.

Variations in students' responses to the data gathering procedures are exemplified in the following interview excerpts. Beth acknowledges discomfort at the presence of recording equipment.

B (Beth): At the start [I didn't like it], yes. Because I was like, I don't (like) cameras and I don't like being recorded and it was like, Ick! Can't talk! [Winifred laughs] Must sit here and just do my work. And then there would be this camera, this um thing that was like_ hmm hmm [rhythmic; indicates silence] And then someone would talk to me and I'd hmm hmm [indicates she ignores the questioner]. But after a while it was just like, yeah, whatever_ thing there. If I'm going to swear, I'm going to swear. They are going to hear it, who cares! So, yeah, but the camera, that_ didn't like that. (si 29/8/01)⁶

In contrast, Winifred expresses enjoyment at being noticed in the course of the observation procedures and takes it as an opportunity to impress others or to prove herself, although I observed that she seemed to be a little cautious or self-conscious when the microphone was near her.

W (Winifred): When I had the mic next to me nothing happened much [tone of disappointment]. And then when the mic went to someone else I was like_ everything happened! [laughter] So I missed out on my_

R (Researcher): On, on your moment of fame?

W: Yes I did! [R chuckles] But I was, oh yeah, I didn't_ But I didn't ask Miss [Keall] for help that much. I think you caught me on the camera once, when I was going around to go help someone else. And I was trying to ---!

...

W: I tried to impress you actually! [Beth chuckles] I tried to impress you actually. I was trying to see if you could see, and you didn't catch it so I was like, is she looking? Is she looking? [laughing] (si 29/8/01)

Likewise, Ben doesn't appear overly concerned or influenced by the recording procedures.

Bn (Ben): Probably [the microphone affected me] a little bit. I probably refrained myself from a few smart arse comments to people but apart from that not really.

R: Did you feel like you played, actually played up because it was there? Did you do_ anything_?

Bn: Nup. Not really.

R: What about in the way that you actually worked? What you did?

Bn: Just the same as usual.

R: OK, what about having the video? Did it make any difference?

Bn: Nup because I was around the corner.

R: Yeah, yeah. And what about having me there?... Did that_ alter how you behaved or what you did, how you worked?

Bn: Oh, I prob, I probably would have, you know, probably didn't say a few things that I was going to say but_ not really. Not a great deal. (si 2/11/01)

Fear of being judged and concern that their teacher might see what they do or hear what they say are constraining factors for some students. For example:

⁶ See Appendix C for information on the notation system used in field text excerpts.

A (Angela): Yes I think [the microphone did affect how I behaved]. Yes for the first half an hour or so or maybe not even that. I was sort of conscious that it was there and then you sort of forget about it and next thing you know you are yelling across the room like you always do. I don't think_ I don't think that it made much of a difference. Maybe worked a bit more in case Mrs Keall saw the video or something. (si 24/8/01)

And

B: At the start it scared me coz it is like there is this lady going to be watching us. And Mrs Keall sort of made it sound like you were going to be standing going hmhhhh [signals oppressiveness] Like, OK! And then you come in and like, "Hi" [tentative], and then you'd sit down and you started writing notes and I was thinking, oh, have I been bad? Like I'd get really, really paranoid and it was like_ OK! [signals tension] So, OK. But, I don't know. It was better when you were watching other people. (si 29/8)

Interestingly, the spontaneous response of one student, Luke, to questions about the impact of the research process on students' behaviour indicates that, in his opinion, there is an effect on his teacher's behaviour.

R: ...Anything else that having me there or the mic there or the camera there made a difference with?

Ra (Rawiri): Not really, nup.

Lu (Luke): Teacher acted different.

Ra: OK

Lu: When you were there she was a lot stricter. Like she wouldn't put up with as much as what she would when you weren't there. Like normally if you were just talking for like a little bit she might tell you to be quiet, just like quite nicely. But when you were there she was_ like you talked and she'd be like --- outside of something like that.

Ra: --- yeah.

Lu: You know. She was a lot stricter.

R: I can understand that.

Lu: Yeah. I can too because she had a microphone on as well eh? (si 31/10/01)

I am led me to believe that my presence affected the behaviour of both students and teachers in the case study classes, although some students felt more constrained or threatened than others. This is manifested in obvious behavioural change in some students more than others. However, the teachers and students in the case study classes seemed to become increasingly comfortable with the data collection procedures as time progressed – as they became more accustomed to my presence in the classroom, and as I got to know them and they me.

Trust proved to be an important contributor to the positive relationships established with the classroom participants and in maintaining their cooperation in the research process. In my

assessment, trust was built up as the students came to understand that I was not going to report on them to their teacher, and as I interacted with them as they went about their computing activities. For example, Winifred finds my participation helpful and looks positively on my involvement in the class.

W: Nah! No, no. That [having you sit nearby] didn't put me off. I was just, I was just like_ Is she waiting for me to make a mistake? [chuckles] And I did make a mistake! Oh but you helped me out on that one, when I was stuck. So that was, no but that was good I reckon. Because I learnt how to delete a row_ from you... (si 29/8/01)

My position outside of the school discipline structure is significant for some students. For example, my non-teacher status helped me to gain the confidence of Kathy and Lisa.

R: What about having me beside you? Did that make any difference?

K (Kathy): No. Not for me.

L (Lisa): Nah. Nah. No not really.

R: Not really? Does that mean that it kind of did?

L: Nah.

K: I still didn't do_ much work [laughs].

L: Neither did I. No.

K: OK.

L: Coz you are not a teacher.

R: ...would it have made a difference if I was a teacher?

K: Yes [adamant].

L: Yip

K: I would have done more work.

...

R: So you think it was kind of like normal what I saw?

K: Yeah.

L: Yeah. (si 19/10/01)

By implication, Lisa and Kathy think their behaviour would have been more constrained and out-of-character if I was a teacher at KHS. Establishing their trust went some way to reducing students' inclination to be cautious and behave better than usual to avoid possible disciplinary repercussions.

Trust between the teachers and myself was established through the negotiation and implementation of ethical procedures, and also from a shared professional identity and

teaching experiences. Ironically, mild deception in the form of incomplete disclosure of opinions was part of maintaining the teachers' trust. When a teacher would ask me for my opinion on what they were doing or on how their school compared with others I would give a general and complimentary response. I wouldn't lie, but I would be restrained in my response. I felt that to express criticism would have a negative impact on our relationship and make them more reserved or cautious in my presence, more restrained than they already were in the presence of an outsider. Maintaining the teachers' goodwill was important and my dissimilitude was aimed at ensuring their continued participation. This type of deception is something Punch (1998) considers to be intrinsic in social life and therefore also in fieldwork – a pragmatic measure to minimise harm using what some might construe as dishonest means.

Treatment of field texts

The social constructionist perspective on which this thesis is predicated challenges ideas that personal accounts provide true or realistic, unambiguous descriptions of events that can be synthesised into clearly identifiable, discreet categories. Rather, participant and researcher accounts are viewed as socially constructed, potentially ambiguous, interpretations of events. This has methodological implications regarding the treatment of field texts. If one accepts that explanations given by people are potentially contradictory and multi-faceted, it is important that sight is not lost in the analytical process of the way that people knit ideas together in accounts of events, nor of the subtlety and nuance in those accounts (Reissman, 1993).

Several strategies are employed in the treatment of the field texts to aid the credibility of the analysis. At the level of field text production and transcription, the system used for the management of interview and conversation transcripts identifies speech features such as pauses and voice tone (see Appendix C), which assists with the interpretation of the texts in their subtle and nuanced form, and in the construction of meaning from the data. In the analysis and reporting of data, the integrity of the data is maintained by conscious efforts to avoid the disaggregation of textual records and the loss of awareness and appreciation of context that may result. The inclusion of extensive excerpts in the thesis maintains the interactive, conversational nature of interviews and classroom talk, as ideas are negotiated and clarified and as participants give meaning to events or situations. The researcher is kept in the frame, as questioner in the interviews and sometimes contributor in classroom conversations

and interactions. This means that the way in which the researcher guides the participants' accounts is not hidden from the reader.

In addition, the reporting of research findings takes the form of a descriptive narrative, involving a search for themes evident in the field texts. In this search, detailed descriptive accounts of individual students' experiences in specialist IT classes are presented for selected students, supported by excerpts from the transcripts and references to observation notes. This thesis represents a synthesis of ideas and the field text excerpts that are quoted are but a small proportion of the textual record, necessarily abbreviated and selectively quoted in the interests of clarity and conciseness. However, the process of analysis and writing began with the production of detailed descriptions and extensive references to field texts. As themes emerged and solidified in the analysis and writing process the scope of the thesis was refined and particular embedded cases and excerpts were given greater prominence than others in the final product. However, these decisions were taken later rather than earlier in the analytical process, providing confidence that what is described is an honest and supportable account of students' experiences in specialist IT classes.

Analysis and representation

In qualitative research the collection of data, data analysis and written representation are inextricably linked. The interpretive process is a creative act through which raw data is given meaning in a final report (Denzin & Lincoln, 1998a; Marshall & Rossman, 1999). This process has been described as "an acquired aptitude for magic" (May, 1994, p.17).

Recognition of the context within which texts are produced is an important factor in the interpretation of texts that record human experience (Clandinin & Connelly, 1998), as is openness on the part of the interpreter to typicality, difference and nuance in the texts (Opie, 2003). Denzin and Lincoln (1998a) see qualitative interpretation as an art where interpretations are constructed in three stages or processes: firstly, field text creation; secondly, the re-creation of field texts into a working interpretive document that represents a researcher's initial attempts to make sense of what has been observed and recorded; and finally, the production of the public text or final product. The analysis process of my research is analogous to Denzin and Lincoln's analytical stages.

Analytical phases

The analysis on which this thesis is based took place in four distinct, but overlapping, phases. Phase one was the collection and organisation of data. This involved the creation of field texts and equates with Denzin and Lincoln's first stage of analysis. Morse (1994) refers to this as the comprehending stage, where the processes of data collection and analysis help the researcher to sort the data and uncover underlying meaning in the texts, which "brings both central and peripheral referents to the researchers' attention" (p.29). It is an initial sieving process. At this stage I made decisions about what should and should not be recorded in the observation notes and transcripts. This sieving process is clearly evident with regard to the creation of observation notes where it was impossible to record all that a student said or did, or all that happened in the classroom. I endeavoured to track what a particular student did for the duration of an observation lesson. This included the computing tasks that were undertaken, the nature of interactions between the student and his or her peers and teacher, how he or she went about solving difficulties encountered and whether the student was on-task or off-task. In relation to interview texts, the guiding questions for the student and teacher interviews also acted as a sieve, allowing some ideas to pass and potentially blocking others. The interviews revolved around questions that I thought would provide a way of understanding the meaning students make of their experiences, such as their likes and dislikes in relation to the specialist IT course in which they are engaged and to computers and computing. Gender was addressed in the interviews, in questions relating to perceived differences in boys' and girls' computing interests and capabilities, but not until the end of the interviews so as not to distort earlier responses and force students to account for their experiences as matters of gender when they may not have seen them as such, or it may not have been something that they consciously or spontaneously considered.

Phases two and three of the analysis process constituted the re-creation stage of Denzin and Lincoln's schema and saw the formulation of a working interpretive document. Phase two was the initial interpretive activity, which involved the construction of a rich description of the students' experiences in specialist IT classes. This involved the generation of interpretive texts pertaining to the nature of the enacted curriculum in the case study classes and the ways that individual teachers organised and presented the curriculum, individual boys' and girls'

observed actions and interactions in lessons and the constructions they placed on their experiences in their IT class. At this phase, the analysis was centred at the level of individual embedded cases. Phase three involved the interrogation of the field and interpretive texts, looking for patterns, similarities and differences, consistencies and inconsistencies relating to the phenomena that were the focus of the research – students' experiences and gender relations. The focus was on cross-case comparison and analysis. Themes emerged from this interrogation. Discussion was generated around the focusing questions, which were adjusted and refined in light of progressive data analysis. This was synthesising and theorising activity. The interpretive text that was produced in phases two and three forms the basis of this thesis.

The final phase saw the formulation of the final product, the thesis of public record. This entailed an extension on the theorising of phases two and three, as broad patterns and themes were discerned, the argument was developed, and overall conclusions were drawn. The form of the thesis was refined and finalised.

Analytical technique

There is no single, predefined technique described in methodological literature for analysing students' classroom experiences. The techniques I used were guided by my desire to maintain the integrity and context of the dialogue in the treatment of the field texts. Basically, I engaged in multiple readings of the field texts, looking for signals or clues in the dialogue and observed social interactions that explained how and why the curriculum is organised in particular ways and illuminated the nature of students' experiences in specialist IT classes. This meant looking for factors that influence the meaning or constructions students make of their experiences, including the judgements they make about computers and computing and about the specialist IT courses in which they are engaged; also, how gender relations influence their experiences and *vice versa*. In the first instance this involved a holistic reading, surveying the whole text, in the process of which I highlighted what struck me as pertinent comments or actions taken by participants relating to the phenomena of students' experiences and gender relations. The texts and highlighted points were revisited as key themes emerged and were developed through the writing process. Detailed descriptions were built around the different cases. As contradictions were illuminated and questions emerged about the meaning of the data a deeper reading of the field texts was undertaken.

The physical identification and labelling of features in the field texts was achieved with a highlighter pen, pencil and coloured stick-on notes. Key words and phrases were drawn over in the field texts. Notes were added to the margins, which helped in the translation or interpretation of the messages. These included annotations that identified key concepts, the tone and context of conversations, and the activity that was taking place. Written notes queried the meaning or interpretation of different statements or non-verbal signals. Stick-on notes were used to flag pertinent data. Where relevant, references were made to other episodes in the same or other field texts that illuminated themes or presented similar or contradictory ideas. The process helped to clarify experiences that were typical and unusual for individuals and formed the foundation of subsequent cross-case comparisons and broad thematic discussion.

Writing is an integral part of the analytical process. In qualitative analysis, especially that associated with phenomenology and ethnography, writing is a way of organising thoughts, clarifying ideas, sorting out relationships in the data and deepening the analysis (Coffey & Atkinson, 1996; Fetterman, 1998; St. Pierre, 2002). Taylor and Bogdan (1998) observe that many people who are new to qualitative data analysis struggle to record and code data, because data analysis “is not fundamentally a mechanical or technical process; it is a process of inductive reasoning, thinking, and theorizing” (p.140). Holliday (2002) describes qualitative writing as an interactive process and an unfolding story whereby the author “gradually makes sense, not only of her data, but of the total experience of which it is an artefact” (p.131). Thus, I engaged in the process of writing as a mode of analysis, not as something that was done after the analysis.

This analytical process posed practical challenges and frustrations, chief amongst these being the time consuming nature of the procedures and the large volume of text that was generated. This text needed to be processed in the interpretation and retelling of participants’ accounts of their experiences with computers and of specialist IT courses. Despite the frustrating and sometimes intimidating nature of the task, I persisted with the procedures I have described in the belief that to restrict the scope of descriptive analysis early on would run the risk of missing that which was hidden, unexpected or serendipitous, and that the very process of writing would help to clarify ideas and draw out themes. This is a deviation from traditional

content analysis that seeks to isolate themes and recurring motifs for counting (Denzin & Lincoln, 1998b). Rather, a close interpretive reading of the field texts was afforded.

This thesis constitutes a meta-story, the hybrid narrative that results from the editing and reshaping of others' stories and interpretations of the significance of these stories (Reissman, 1993; Kvale, 1996). In the telling of the stories relating to boys' and girls' experiences in specialist IT classes, gender relations are revealed. They are exposed in everyday male-female interactions and in the meanings that students make of these interactions. The meta-story is a worldly creation, an interpretation of other's experiences. It privileges my authorial voice and interpretation over that of the participants, even though I endeavour to be true to the participants' accounts and meanings by including their voices and weaving excerpts of their accounts into the thesis. Such is the nature, the strength and the ambiguity, of interpretive qualitative research.

Summary

The methodology adopted in this thesis facilitates a search for meaning in the lived experiences of students, male and female, in specialist IT classes and the illumination of gender relations in those experiences. I look for the key or common factors in students' experiences and gender relations in the context of the case study classes, whilst retaining a social constructionist wariness of universal truths. This thesis presents reconstructions of participants' experiences; that is, the social interactions and meanings that are attributed to those interactions by the players. It is thus a meta-narrative, a retelling of others' experiences. The stories of individuals are combined to create a bigger or broader representation. The findings posited in this thesis should be viewed as interpretations of the lived realities of classroom players, which may illuminate broader social phenomena but do not comprise an incontrovertible truth.

The methodology I have employed fits broadly within a qualitative research framework. Key features of this methodology are:

a philosophical foundation in social constructionist, phenomenological and feminist worldviews;

a case study structure to data gathering and interpretation, comprising selected specialist IT classes and focusing on particular participants in those classes;

concern for context, reflected in research components that describe the IT curriculum structures at national and local levels and the curriculum in practice in the case study classes;

employment of a mixture of quantitative and qualitative methods, the questionnaire survey and analysis providing an example of the former and the participant observation and interview strategies examples of the latter;

emphasis on participant observation as a research mode, where students and teachers are observed in the natural settings of different classrooms and where the researcher is part of those classroom cultures or environments;

the primacy of writing as a mode of analysis;

the generation of rich descriptive text based on thematic analysis.

Different people's experiences of the same phenomena may be quite varied and there is no simple schema for describing and analysing experience. To understand others' experiences one must watch and listen, looking for the tangible clues in language and physical responses that reveal the understandings, attitudes and beliefs that are constructed. The methodological focus of this thesis is directed at providing rich description of students' interactions and activities in specialist IT classes, their views on computing and the constructions they place on their personal experiences of specialist IT courses. The emphasis is on the social construction of meaning rather than the mental processes by which students acquire computer skills and knowledge. It is experiential rather than cognitive in orientation, inductive rather than deductive in process.

Chapter 4 Gendered IT curriculum

What is the structure of the formal New Zealand IT curriculum at national and local levels? Is the formal IT curriculum gendered?

The formal national curriculum for information technology (IT) constitutes the collection of subjects for which computers are the content and mode of learning. The New Zealand IT curriculum comprises a variety of subjects, such as computer studies (CPS), text and information management (TIM) and computer assisted design (CAD). These subjects are associated with different curriculum domains, including computing, commerce/business studies and technology. The IT curriculum at the local level comprises the collections of subjects offered for study in individual schools, organised in unique ways in particular school settings.

When investigating whether the curriculum is gendered one could be asking several things. Are particular subjects dominated by one gender? Do males or females participate in greater numbers in particular subjects? It could be argued that the curriculum has a gendered character if students and/or teachers in different subjects are predominantly male or female. The assumption or implication of gendered participation patterns is that there are gendered preferences pertaining to the use of computers and that different subjects are of greater relevance or interest for particular genders. This hints at another interpretation of a gendered curriculum, which focuses on the content of different IT subjects. Is a subject structured in a way that it overtly or implicitly caters for the perceived interests of one or other gender? Does the content or emphasis given to particular computer practices reflect gender stereotypes relating to male and female computer uses? The IT curriculum could be seen to be gendered if different IT subjects are aligned with or defined by perceived differences in the computer interests and activities of males and females in the way that the subjects are organised. This would contribute to the creation of masculine and/or feminine subject identities (subjectivities) and a gendered curriculum culture across subjects. There is a gendered curriculum culture where there are gendered subject cultures.

The early portion of the chapter provides a macro view of the national curriculum and the later section focuses on the curriculum offerings in a particular school, Kahikatea High School (KHS). At the macro level the structure of the New Zealand curriculum is described and a comparison is made of participation patterns and written subject guidelines for two of the more popular specialist IT subjects, CPS and TIM. At the school level an examination of IT curriculum arrangements at KHS provides a case study of curriculum developments *in situ*. It offers an example of how the national curriculum is organised in a particular local setting and sets the context for the discussion pertaining to the case study classes in subsequent chapters.

National IT curriculum

Contestable curriculum

The national IT curriculum has changed and become increasingly contestable as new subjects have emerged and traditional curriculum domains have been reformed. The boundaries between subjects have blurred. The subject of CPS emerged in the 1980s, comprising a new curriculum domain and offering an alternative to the erstwhile mathematical computing tradition. In contrast, TIM emerged from an existing office practice curriculum tradition and was part of commerce or business studies domains in schools. Courses such as shorthand and typing declined in popularity and were superseded by TIM and related courses in the 1990s.

Statistics of enrolments in nationally recognised subjects reveal an expansion of offerings associated with computers at different secondary schooling levels in the 1990s (see Table 6). In 1990 there was only one nationally recognised specialist IT course, year 12 CPS, but by 2000 there was a variety of computer related subjects across a range of levels. By the year 2000 TIM had become the second most popular subject of those associated with commerce/business studies, next to typing. Computer studies is the most popular specialist IT subject in years 12 and 13. However, TIM and the subject called IT are relatively popular at younger levels (MOE, 1991, 1992, 1996a, 1996b, 2001a). The results of a national questionnaire survey (see Appendix A) conducted in the year 2000 as part of the original

Table 6: Total enrolments in nationally recognised subjects

Year	Course/subject	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13
1990						
	CPS				691	
	Shorthand typing			911		
	Typing			11132	3625	
	Secretarial studies and typing				2151	
1995						
	Computer studies	9160	3646	1870	12768	1576
	IT	2368	1376	403	1693	474
	Shorthand typing	268	379	188	169	10
	Typing/TIM	18135	12541	9986	4657	1292
	Office/Secretarial related studies	48	1	44	409	157
2000						
	CPS	5074	3436	2257	9444	4385
	Computer related studies	958	881	970	1479	772
	IT	3517	2020	1085	1113	636
	Shorthand typing	5	4	37	46	58
	Typing	6017	6365	5923	2769	1088
	TIM	4423	4935	4363	2271	986
	Office/Secretarial related studies			7	313	245

Source: MOE, Education Statistics for New Zealand

Note: In 1990 data is only reported for enrolments in subjects for national qualifications.

Table 7: Numbers of courses by year level

Course/subject	Year level									
	9	10	11	12	13	5+	9+	11+	12+	14+
Business studies/administration			1	5	4				5	
CAD				3						
Computer science				1	1					
CPS	14	13	9	81	41		5	3	17	2
Computing	19	14	11	33	16		2	2	7	
DTP (Desktop publishing)	1	1	1	2	1				1	
General class				1	1	1	2		3	
Graphics/Graphics and design/Design	1	2	2	6	1					
ICT	25	11	2	4	4		1		1	
IMT (IT and TIM combined)			1	1	1					
Introduction	2	1	1	2			1			
IT	30	18	6	10	7	2	2	2	2	1
Keyboarding	15	3		1		1				
Multi media				1	1		1			
National Certificate in Computing			1	2						
Office/Office technology				1	2					
Programming				1					2	
Technology/Computer										
technology/Communications technology	10	5		1	2	2	1			
Text processing			1	2	1				1	
TIM/TIP (Text and information										
management/processing)	38	68	85	53	27		7	6	6	
Typing	2	5	8	3			1	1	2	
Word processing	1	2	2	6	3				1	

Source: J. Abbiss, 2000. Questionnaire survey of New Zealand secondary and composite schools. Unpublished data.

Notes:

1. Non-specialist IT subjects reported by some schools as specialist IT subjects have been excluded, such as sports science, accounting, mathematics, history and tourism, as have subjects where the nature or emphasis of the course is unclear.
2. The count is for courses/subjects offered. There may be multiple classes in a school for any subject.
3. The + symbol is used where schools report class numbers for a range of year levels, rather than for a single year level.
4. Results are reported for subjects with students in year 9 and older.

research for this thesis confirm a proliferation of specialist IT courses (see Table 7). Various names are given to computer courses in secondary schools, as revealed in the titles reported by schools in Table 7. The survey reveals that some subjects tend to have greater numbers of classes in the younger secondary schooling years, such as information and communication technology (ICT) and IT, and others at the senior years, especially TIM and CPS. This is perhaps not surprising given that TIM and CPS are subjects for national qualifications at the senior level and have nationally defined subject guidelines. It appears that some courses – ICT, IT and keyboarding – are positioned by schools as introductory, entry level computer related courses and that others are more prominent in the senior school when students are selecting subjects for national qualifications.

With the expansion of the number and type of specialist IT subjects there is a blurring of boundaries between domains and considerable potential for overlap between courses. There is a multiplicity of course combinations and the nature of particular courses may vary considerably between schools. For example, what is called CPS in one school may be very similar to IT or TIM in another school. In the questionnaire responses it is difficult to classify some courses as belonging to one tradition. The subjects called IT and ICT are administered by different departments in different schools and may employ a diverse range of software applications. In specific examples from the questionnaire responses, one year 10 ICT course in a school uses desktop publishing, word processing, spreadsheet, PowerPoint and Microsoft Office applications, and another school utilises QBasic programming, graphics and spreadsheet software. A different school again bases its year 10 ICT course on worldwide web and HyperStudio use. Programming and CAD applications feature at different levels and in courses by a range of names – CPS, computer science, technology, graphics and design. This suggests that there is a national trend towards the merging of the computer subjects and traditions as new courses are developed and implemented at school level. The specialist IT curriculum presented in schools is potentially highly varied. The combinations of subjects and content emphasis have unique forms at school level.

The burgeoning of specialist IT courses offered in schools has happened in conjunction with nationwide curriculum and assessment changes in the 1990s. The introduction of the national

curriculum for technology potentially changes the way technological subjects are organised in schools. Information and communication technology is designated as one of seven technological areas “around which the technology curriculum in schools can be organised and developed” (MOE, 1995, p.12). Technology is designated an essential learning area, and all students up to year 11 must engage in some form of technology education.

The main schooling qualifications for years 11 to 13 respectively during the 1990s were School Certificate (SC), Sixth Form Certificate (SFC) and University Bursary (UB). National subject guidelines for conventional qualifications were developed at some levels for selected specialist IT subjects. A new qualification, National Certificate (NC), was introduced in the 1990s and offered an alternative and parallel assessment pathway across a range of generic school subjects, through the mechanism of unit standards. A qualification called the National Certificate in Computing (NCC) was introduced for levels 2, 3 and 4 of the qualifications framework and the National Certificate in Business Administration and Computing (NCBAC) was introduced for levels 2 and 3. Levels 2 and 3 on the qualifications framework are equivalent to years 12 and 13 respectively (New Zealand Qualifications Authority [NZQA], www.nzqa.govt.nz, downloaded 11/6/01 and 17/6/04).

Computer studies emerged as a school subject in the 1980s as part of the technological revolution that saw increasingly widespread workplace and home use of computers. The SFC course guidelines for computer studies (NZQA, 1993) were developed in an attempt to legitimate developing computer education practices in secondary schools by providing a qualification and to establish a cognitive frame for what had previously been *ad hoc* development of specialist computer studies education within schools. Historically CPS has had qualifications status for SFC, but not at other levels in the senior secondary school. It has never been a subject for SC or UB qualifications at years 11 and 13 respectively, although with the introduction of unit standards in the 1990s credits could be gained towards NC. Examples of level 2 generic computing unit standards are:

- | | | |
|------|-----------|--|
| 2786 | 3 credits | Create and use a simple computer flatfile database to solve a problem |
| 2791 | 3 credits | Integrate spreadsheet and database data into a word processed document to solve a problem. |

(NZQA, www.nzqa.govt.nz, downloaded 29/1/04)

Text and information management developed from a different curriculum convention. It emerged from the office practice tradition as typing gave way to keyboarding and then to TIM and ICT. National TIM courses were developed for SC and SFC, at years 11 and 12 respectively. TIM has not had UB status. Unit standards were also developed for TIM and appear in the generic and business information processing domains of the qualifications framework. Level 2 examples are:

12885	6 credits	Create and enhance documents combining text and images for generic text and information management
103	3 credits	Use data entry skills to input computer data
16678	1 credit	Key in text at 25 words per minute (wpm).

(NZQA, www.nzqa.govt.nz, downloaded 29/1/04)

In the late 1990s widespread change to the traditional national school qualifications was mooted, with National Certificate of Educational Achievement (NCEA) planned to replace SC, SFC and UB qualifications, beginning with SC in 2002. With the demise of the older qualifications the existing subject guidelines were to be superseded by the specifications for individual achievement standards and unit standards pertaining to NCEA Technology, levels 1 to 3, and NCEA Information Management at level 1. The NCC and NCBAC would be retained. Schools would be able to offer a range of achievement standards and unit standards in specialist IT courses.

Actual and anticipated changes in national curriculum and qualifications have encouraged schools to reassess the ways in which they organise their curriculum and to engage in internal curriculum reform. This is reflected in the results of the questionnaire survey reported in Table 7. Winter (2002) similarly reports a variety of qualifications and assessment options pertaining to ICT and TIM in different schools. She finds that schools see ICT and TIM fitting into a variety of curriculum documents and that there are various names for computer subjects – information science (IS), information management (IM), IT, ICT, TIM and CPS. The teacher participants in her study had difficulty defining these terms and, by implication, difficulty distinguishing between the different subjects.

The proliferation of specialist IT subjects and expansion of assessment provides potential for content overlap and a contestable curriculum in practice. Both TIM and CPS are applications based, technocratic subjects – focused on learning how to use applications to generate products such as word processed documents, database forms and reports, spreadsheet graphs and tables. Change to the assessment structure means that specialist IT courses in the senior school can lay claim to the same computer related achievement standards and unit standards. However, the regulations for NCEA mean that students cannot earn credit twice for the same standard in different subjects. Therefore, the assessment mechanisms that are appropriated in different courses, and the content associated with these, is open to negotiation at school level.

Gendered participation patterns

National statistics of enrolments in specialist IT subjects from the different domains present a picture of gendered participation patterns (see Tables 8 and 9). Subjects from the computing and commerce/business studies domains have mixed-gender followings, but those associated with commerce appear to be more strongly gendered. TIM and related office practice subjects are dominated by one gender (female) to a greater degree than computer studies and related subjects.

In the 1990s males tended to make up a higher proportion of enrolments than females in CPS at different levels, but this difference was within relatively few percentage points. Females outnumbered males in some years at some levels. The enrolment statistics for the subject IT show a similarly complex picture, with subtle variations in gender balance. Female enrolments exceeded males at most levels, but not at all levels in all years. In contrast, the subject TIM was clearly dominated by females at all levels, as were other office practice related subjects. However, a relatively high proportion of the age cohorts in TIM were male in years 9 to 11 compared with the older years. It appears, then, that the gender balance in enrolments has varied with different levels and by subject. The national enrolment statistics suggest that CPS and related courses have had similar appeal to males and females but that TIM and other office related subjects have had far greater appeal to females than to males. There have been

persistent gender based differences in national participation patterns in different specialist IT curriculum domains.

Table 8: Enrolments in nationally recognised specialist IT and related subjects by gender

Year	Course/subject	Level	Yr 9		Yr 10		Yr 11		Yr 12		Yr 13	
			M	F	M	F	M	F	M	F	M	F
1990	CPS								392	299		
	Secretarial studies and typing								45	2106		
	Shorthand typing						15	896				
	Typing						430	10702	59	3566		
1995	CPS		4840	4320	1941	1705	853	1017	6396	6372	740	836
	IT		1073	1295	554	822	173	230	704	989	223	251
	Office/Secretarial related studies		23	25	0	1	16	28	92	317	38	119
	Shorthand typing		31	237	25	354	3	185	6	163	1	9
	Typing/TIM		6833	11302	2605	9936	1266	8720	415	4242	126	1166
2000	CPS		2685	2389	1940	1496	1313	944	5146	4298	2502	1883
	Computer related studies		476	482	535	346	411	559	716	763	369	403
	IT		2000	1517	966	1054	555	530	474	639	204	432
	Office/Secretarial related studies						3	4	59	254	45	200
	Shorthand typing		0	5	2	2	6	31	1	45	8	50
	TIM		1837	2586	1507	3428	1129	3234	440	1831	214	772
	Typing		2098	3919	1787	4578	1412	4511	502	2267	237	851

Source: MOE, Education Statistics for New Zealand

Table 9: Proportion of national enrolments by gender

Year	Course/subject	Level	Yr 9		Yr 10		Yr 11		Yr 12		Yr 13	
			M	F	M	F	M	F	M	F	M	F
1990	CPS								0.57	0.43		
	Secretarial studies and typing								0.02	0.98		
	Shorthand typing						0.02	0.98				
	Typing						0.04	0.96	0.02	0.98		
1995	CPS		0.53	0.47	0.53	0.47	0.46	0.54	0.50	0.50	0.47	0.53
	IT		0.45	0.55	0.40	0.60	0.43	0.57	0.42	0.58	0.47	0.53
	Office/Secretarial related studies		0.48	0.52	0.00	1.00	0.36	0.64	0.22	0.78	0.24	0.76
	Shorthand typing		0.12	0.88	0.07	0.93	0.02	0.98	0.04	0.96	0.10	0.90
	Typing/TIM		0.38	0.62	0.21	0.79	0.13	0.87	0.09	0.91	0.10	0.90
2000	CPS		0.53	0.47	0.56	0.44	0.58	0.42	0.54	0.46	0.57	0.43
	Computer related studies		0.50	0.50	0.61	0.39	0.42	0.58	0.48	0.52	0.48	0.52
	IT		0.57	0.43	0.48	0.52	0.51	0.49	0.43	0.57	0.32	0.68
	Office/Secretarial related studies						0.43	0.57	0.19	0.81	0.18	0.82
	Shorthand typing		0.00	1.00	0.50	0.50	0.16	0.84	0.02	0.98	0.14	0.86
	TIM		0.42	0.58	0.31	0.69	0.26	0.74	0.19	0.81	0.22	0.78
	Typing		0.35	0.65	0.28	0.72	0.24	0.76	0.18	0.82	0.22	0.78

Source: MOE, Education Statistics for New Zealand

Student participation figures from the questionnaire survey in 2000 show similar patterns to those in official statistics. Based on the enrolment figures for the five most popular specialist IT subjects, as reported by respondent schools, it is apparent that courses labelled CPS have a stronger male following. In contrast, those labelled TIM have far greater numbers of female enrolments than male, although there are variations in the male-female balance for different cohorts (see Table 10). For example, of the 3175 students enrolled in year 9 TIM, 31% are male. This compares with 24% of year 11 TIM enrolments and 14% for year 12. In contrast, females make up 15% of CPS enrolments in year 11 and 40% of those in year 12. Also, there are distinct differences in the proportions of males and females participating in different subjects (see Table 11). For example, of the total number of year 12 students participating in the five most popular courses, 60% of the males are involved in computer studies, compared with 35% of the females. At year 13 and higher the proportions are 70% and 31% respectively. This contrasts with TIM where the balance is reversed. Six percent of year 12 males participate in TIM, compared with 31% of the females. The figures are 6% and 25% respectively for year 13+, and 42% and 80% for year 11. It appears, then, that year level plays a part in the gendering of the curriculum. For example, TIM has a greater following among males at younger years of secondary schooling. The female following for CPS is strongest in year 12.

The type and number of specialist IT subjects also varies with the gender mix of a school (see Table 12). The trend within single-sex girls' schools is to offer more courses from the commerce/business domain and office practice tradition. In contrast, boys' schools have a propensity for CPS. It is not known to what extent these differences are a reflection of student demand or a function of restricted school subject offerings. Regardless, the mix of IT courses presented in single-sex schools can be seen to reinforce stereotypical associations of office practice as preferred work and learning for females and of other forms of computing as preferred by males, thus contributing to the gendering of specialist IT curriculum domains.

So what is different about the subjects from different curriculum domains that might lead to these differences in participation patterns? Is there something in the content of different subjects that may have greater appeal for males or females?

Table 10: Numbers of males and female enrolments in popular courses

Course/Subject	Yr 9		Yr 10		Yr 11		Yr 12		Yr 13+		Mixed level		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Computing	934	1371	124	540	270	222	805	750	81	174	233	210	2447	3267
CPS	571	537	554	209	442	76	1545	1041	381	239	539	583	4032	2685
ICT	1130	1591	403	400	30	102	1	50	22	41	38	77	1624	2261
IT	1010	973	231	252	283	187	86	245	32	113	185	193	1827	1963
TIM	1000	2175	1012	2565	728	2293	155	928	32	193	167	1098	3094	9252
total	4645	6647	2324	3966	1753	2880	2592	3014	548	760	1162	2161	13024	19428

Source: J. Abbiss, 2000. Questionnaire survey of New Zealand secondary and composite schools. Unpublished data.

Table 11: Proportion of male and female enrolments in popular courses

Course/Subject	Yr 9		Yr 10		Yr 11		Yr 12		Yr 13+		Mixed level		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Computing	0.20	0.21	0.05	0.14	0.15	0.08	0.31	0.25	0.15	0.23	0.20	0.10	0.19	0.17
CPS	0.12	0.08	0.24	0.05	0.25	0.03	0.60	0.35	0.70	0.31	0.46	0.27	0.31	0.14
ICT	0.24	0.24	0.17	0.10	0.02	0.04	0.00	0.02	0.04	0.05	0.03	0.04	0.12	0.12
IT	0.22	0.15	0.10	0.06	0.16	0.06	0.03	0.08	0.06	0.15	0.16	0.09	0.14	0.10
TIM	0.22	0.33	0.44	0.65	0.42	0.80	0.06	0.31	0.06	0.25	0.14	0.51	0.24	0.48
total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: J. Abbiss, 2000. Questionnaire survey of New Zealand secondary and composite schools. Unpublished data.

Table 12: Number of specialist IT courses by domain and gender

Domain	Course/subject	mixed-gender	School gender	
			single-sex male	single-sex female
Computing	CPS	119	33	33
	Computing	64	11	30
	NCC	1	2	
	Computer science			2
	Programming	3		
	Total	187	46	65
Commerce/business studies	TIM	213	2	72
	Text and information processing	9		2
	Keyboarding/typing	29	2	11
	Word processing	9		6
	Desktop publishing	7		
	Business studies/administration	10		5
	Office/Office technology	5		
	Total	282	4	96
Graphics/technology	CAD/Computer graphics	4	1	
	Graphics/Graphics and design	1	1	6
	Technology	17		3
	Total	22	2	9
Miscellaneous	General/Introduction/Computer skills	12	2	4
	Information management/processing and Communication technology	3		1
	Computer technology	1		
	IT	57	7	14
	ICT	28	3	17
	Total	101	12	36

Source: J. Abbiss, 2000. Questionnaire survey of New Zealand secondary and composite schools. Unpublished data.

Gendered subject identities

Turning to the character of specific subjects and focusing on two subjects from different curriculum traditions, CPS and TIM, one can perceive subtle gendering in the emphasis given to different aspects of computer practice in the national subject guidelines and published supporting materials. This is achieved through association with practices traditionally dominated by males and females.

At the time of this research SFC is the mainstream school qualification for year 12. The SFC course for CPS was developed as a general computer course, as exemplified in the following excerpt.

The course should not be viewed as direct preparation for a career in computing; its orientation is non-vocational. Rather it should alert students to the types of tasks for which computers are used, the broad range of occupations which involve computers, and likely future applications both in work and leisure. The emphasis in the course is on the practical. In addition it provides an opportunity to discuss in some depth the interaction between people and computers, and people's response to the technology. (NZQA, 1991, p.347)

The SFC national subject guidelines for CPS are structured around three themes: the applications and implications of computing; the technology of computing; and the techniques of problem-solving using computers (NZQA, 1998). The objectives include a mixture of the technocratic and the critical – including objectives for students to develop competency in the use of software and understanding of basic computer systems and computer developments, and to investigate issues relating to the social impacts and ethics of technological developments. Technocratic components form a larger or more prominent portion of the subject guidelines. Computer studies, then, is nationally constructed as a broad, practical subject for users of computers.

Interestingly, gender equity features as a motivation for a general CPS course.

This course is relevant to all students: female and male; Maori and pakeha and those from other cultures; the gifted and the handicapped. There is evidence that girls do not have the same access as boys to computers in schools. It is strongly suggested that schools take affirmative action if necessary to ensure equity of access for all students, to computers and to participation in this course. (NZQA, 1991, p.347)

This excerpt from the SFC prescription assumes differences in girls' and boys' uses of computers, with girls being disadvantaged in relation to access to technology. Gender differences are seen as a problem and the solution is to make computers more appealing to girls – which, it is implied, a general users course will help to achieve.

The SFC statement for CPS includes a programming component. As part of the problem-solving section of the curriculum students are expected to be able to “choose the most appropriate application tool or language to solve a given problem”, which entails knowledge of an electronic spreadsheet, database system and a high level language (NZQA, 1991, pp.351-352). In relation to use of a programming language:

Students will be able to:

1. specify an algorithm which describes a solution for an appropriate problem;
2. use functions, subroutines and/or procedures and use appropriate control structures in a working problem;
3. design, implement, test and document a solution to an appropriate problem using the techniques of structured programming. (NZQA, 1991, p.352)

This could be thought to reflect mathematical computing roots and to be associated with male computer interests, given the reporting in international literature that identify programming with male computer interests (see Chapter 2). Interestingly, though, some published resources supporting CPS at year 12 address programming content and others do not (Bunting, 1999; Department of Education, 1988; Rutter, 2001). It depends whether the resources are oriented towards the SFC guidelines, which have a component relating to problem-solving in a high level language, or are developed for a selection of unit standards, where there is scope to omit the programming component. This suggests that the curriculum for CPS has evolved in a manner that provides considerable flexibility in practice and enables variation in courses in schools.

It is difficult, then, to ascertain whether the CPS curriculum, as described in the subject guidelines and the *de facto* curriculum of assessment requirements, sustains a gendered (male) subjectivity. The potential exists in the guidelines and assessment structures for schools to emphasise or downplay different computing components and consequently to maintain or avoid practices that are associated with computer practices traditionally dominated by males.

The most definitive thing one can say in relation to gender and the CPS curriculum is that the curriculum has the potential to be interpreted and used in ways that challenge or reinforce gender stereotypes and a gendered subject identity, depending on how courses are structured in individual schools.

Text and information management is similarly positioned as a subject for computer users in the SFC guidelines. The 2001 guidelines derive from the 1994 Draft Text and Information Management Curriculum statement (reproduced by NZQA, 2003). The purported aims relate to two strands: text entry and information processing.

The aim of a course of study in Text and Information Management is to empower students to:

- utilise their skills to enter text efficiently and apply safe working practices
- select and use appropriate knowledge and skills to communicate information in order to meet a need/opportunity. (NZQA, 2003, p.176)

The learning outcomes relate to three prescribed skills areas: communication skills, which entails the communication of information from data provided and using direct entry composition, in a way that is fit for the purpose and intended audience; information skills, whereby students access, select and process relevant information from a variety of media; and problem-solving skills, which requires students to apply design principles in the process of identifying, investigating, planning, selecting software, and evaluating solutions in relation to given situations or scenarios.

Materials produced by the New Zealand Commerce and Economics Teachers' Association (NZCETA) to support the development of TIM in schools in the 1990s define two content strands – text entry and information management. They describe a shifting emphasis over the levels, with text entry being the focus in years seven to nine and information management the focus in years twelve and thirteen (NZCETA, 1996). The way TIM is defined in resource materials retains an association with typing/text entry while expanding the content to include a range of possible applications, including word processing, desktop publishing, database spreadsheet and draw/paint software (Main & Barton, 1999a, 1999b, 2000; NZCETA, 1999a; 1999b). The concern with text entry, composition and presentation components of the TIM curriculum at different levels could be seen to maintain a gendered (female) subject identity through association with secretarial and clerical practice.

Whilst the content and software applications of CPS and TIM are similar – for example, both claim to develop skills in problem-solving using computers and both utilise similar applications, including word processing, database and spreadsheets – the subjects are different in emphasis. Their titles provide clues as to their functions. The “studies” component in the CPS title suggests a broad computer course, introducing participants to computers and a variety of applications. The title distances it from the more abstract and technical components that are associated with computer science, computer engineering and electronics. In contrast, the words “text” and “information” signal that TIM is focused on document production and information processing. The components relating to text entry reflect its typing antecedence and position TIM within an office practice tradition.

These developments have gender connotations. It might be argued that the existence of competing specialist IT courses reinforces gendered subject cultures. The points of difference between the courses reflect traditional gender roles in relation to computer use, albeit increasingly blurred divisions. The very existence of different specialist IT subjects from different curriculum domains maintains a division between what have traditionally been differently gendered domains of practice. It helps to create gendered subject identities. Conversely, it could be conjectured that the movement away from the ‘hard’ scientific and technical image of computing would mean that CPS would have broad appeal across genders. Similarly, that the movement to reposition typing as TIM and to extend the content to include applications such as databases and spreadsheets would give TIM cross gender appeal. The similarities between CPS and TIM, the content overlap and common applications based in national guidelines, suggests a potential softening of gendered subject identities. It can be argued, then, that the evolving form of these different subjects both maintains and resists the gendering of subject identities and construction of a gendered IT curriculum culture. However, there is considerable potential for difference in practice, for reinforcement of and resistance to the gendering of curriculum as schools implement the IT curriculum in their unique course offerings.

Local IT curriculum – Kahikatea High School

Curriculum organisation and evolution

The IT curriculum at KHS comprises two main subjects – CPS and TIM. A year 10 CAD course was run in 1999 and 2000, but not in 2001. Courses in CPS and TIM have historically been developed and administered by two different departments. The computer studies department is responsible for CPS and the business studies department for the TIM and antecedent typing courses. The computer studies and business studies departments have separate computer facilities, located in computer laboratories.

Computer studies and TIM are optional subjects at KHS in 2001. At the time of data collection, CPS is only available in the senior school, at years 12 and 13. TIM is offered from years 9 to 12, with business related courses superseding TIM at year 13⁷. The courses for year 10 and higher are one year in duration; those for year 9 are for a shorter period.

Computer studies was introduced to KHS when national SFC guidelines were developed in the late 1980s. It was developed as a general, applications based course.

GL (Mr Lucas): And then we started at the school here, trying to put together the computer studies course when it became a Sixth Form Certificate subject, and, um, I worked with the maths department because they wanted to do a programming course but it was only a *part* of it and they needed the word processing, spreadsheets and database. And because I'd learnt, by going onto these courses you pick up all this stuff, and you finally put it all together. And the first year we had two classes [computer studies]. One, a mathematician, she was the teacher of it, and I prepared the units that were non-maths. She prepared the programming and trained me on programming. I trained her on other things and we ended up with a, a_ really the basis of what, um, is sixth form computer studies, and it just simply went from there. (ti 19/11/01)

Thus the 12CPS course at KHS emerged from the fusing of the mathematical and non-mathematical applications, consistent with the newly developed SFC national guidelines. More recently, selected unit standards have been incorporated into the course, which earn

⁷ In the 2001 KHS Senior Course Book, the year 11 course is called "Text and Information Management"; the year 12 course is titled "Word Processing: Typing"; and the year 13 options are titled "Word Processing and Business Studies" and "Business Administration."

credits towards NC. These unit standards relate to applications offered as part of the SFC course, such as US2784: Create and use a simple spreadsheet to solve a problem.

The introduction of TIM is a more recent school curriculum development. Consistent with the national trend, TIM has superseded typing at KHS. The 12TIM course in 2001 is based on national guidelines for SFC Text and Information Management. As with CPS, selected unit standards are incorporated in the TIM teaching programmes. They include unit standards related to keyboarding and US12885: Create and enhance documents combining text and images for generic text and information management.

Both the 12CPS and 12TIM courses are at a point of transition in 2001 and will be reorganised as NCEA assessment requirements are implemented at KHS. The development of these courses is made with teacher knowledge of contestable content. The options are for the course administrators to: negotiate for each course to incorporate different ICT achievement standards from those that have been developed for the Technology curriculum; for one or both to adopt an alternative assessment mode, which is available through unit standards; or to merge the courses. The teachers at KHS are not considering a merger. Rather they are looking to maintain both courses and negotiate over content and assessment components. It is anticipated that the ICT achievement standards and some unit standards will be appropriated into TIM, and that a different collection of unit standards will be utilised in CPS. At the time of data collection these decisions are yet to be finalised. It is clear, though, that the course administrators are looking for ways to maintain and differentiate their courses through the assessment mechanisms and by utilising different software and emphasising different applications in the content of the specialist IT courses.

The KHS curriculum for specialist IT schooling is conventional in the sense that it reflects dominant national curriculum arrangements and incorporates subjects from different domains. As the national curriculum is subtly gendered, so is that of KHS. It embodies broad, historically defined associations of particular subjects with male and female dominated computer practices. The local IT curriculum at KHS is thus subject to broader gendering processes than operate purely at a school level.

Gendered IT domains

Staffing

The staffing of the IT domains at KHS has a gendered character. The computer studies teachers at KHS are all men. The Head of Computer Studies is Mr Lucas, who teaches the 12CPS case study class, one of two year 12 CPS classes at KHS. He is also part of the senior management team. The other male teacher of CPS is also the school network manager. Females have taught in the computer studies department in recent years, including Mrs Nugent and a relieving teacher, but they have been brought in to fill staffing holes rather than being part of the core CPS staff. In contrast, the majority of teachers in the business studies department are female, and all of the TIM teachers are women. The teacher with administrative responsibility for TIM courses, Mrs Keall, is also the teacher of the 12TIM case study class. I am not suggesting that there is a conspiracy to create an exclusive male CPS teaching fraternity, or an exclusively female TIM domain. Rather, historical circumstances have seen the appointment of males and females in these areas, which have been maintained for a number of years. These staffing arrangements conform to gender stereotypes, with men controlling computer systems and the teaching of CPS and women administering and teaching the TIM courses.

Class composition

The composition of the KHS case study classes is consistent with national trends for gendered participation patterns in different IT domains. The 12CPS class of approximately 20 students is a mixed-gender group, although there are more males than females. Boys outnumber girls by up to five students in the lessons observed. In contrast, 12TIM is an all-female class. Entry to 12TIM is not restricted to girls, but only girls have chosen to take the course in 2001. However, the gender balance differs in the younger TIM class. The 10TIM class is a mixed-gender group, although there is more than double the number of females than males in the class of 28.

The gendered composition of the case study classes observed is consistent with historical trends in participation statistics for KHS. Males have tended to outnumber females in CPS at year 12, although not by many (see Table 13). Similarly, females have outnumbered males in TIM in years 10 and 12 (see Table 15), as they do in typing in the years before the introduction of TIM (see Table 14). It is also interesting to note that the CAD classes are strongly gendered, dominated by males. They appear as computer related studies in MOE statistics (see Table 13). The statistics for enrolments across the years in specialist IT subjects at KHS are also consistent with national trends. Males participate in typing and TIM courses in the younger years, but are represented in much higher numbers in CPS in older years compared with TIM. In contrast, females dominate TIM enrolments from year 11 onwards, markedly outnumbering males. They represent a slightly lower proportion of enrolments in CPS in the senior school.

Curriculum developments beyond 2001 are outside the scope of this research. However, it is evident from MOE statistics that changes in curriculum arrangements occurred at KHS after the completion of fieldwork in 2001 (see Table 16). Computer studies appears as a course of study at years 10 and 11. Interestingly, the differences between male and female numbers in 12CPS have become more distinct, with males comprising a markedly greater proportion of enrolments, as they do in years 10 and 11. At the same time the numbers of males and females at year 13 have reduced and become more evenly balanced. Text and information management enrolments continue to be female dominated at all levels bar year 9. Whatever the curriculum changes that have been enacted, they appear to have effected change in the gender participation patterns, particularly in CPS, exaggerating the trend evident in earlier years of CPS as a subject preferred by males.

Participation patterns for the case study specialist IT classes indicate that there is a gendering of curriculum domains at KHS. In 2001 the gender differences are most distinct at year 12, where there are competing subjects. These gender differences in participation hint at a gendered curriculum in practice at classroom level, implying that there may be an association of different course content with male and female computer practices or preferences. However,

given the flexibility of curriculum and assessment structures, this cannot be assumed. A deeper analysis of the constructions of case study specialist IT courses in practice is required.

Table 13: Kahikatea High School enrolments in CPS and Computer Related Studies

	Year 9	Year 10	Year 11	Year 12	Year 13+	Total
1995						
Male				35	7	42
Female				43	9	52
1996						
Male				32	20	52
Female				23	16	39
1997						
Male				18	18	36
Female				15	8	23
1998						
Male			1	20	10	31
Female				15	9	24
1999						
Male		14	1	18	19	52
Female		3		16	12	31
2000						
Male		24		23	23	46
Female		2		18	14	32
2001						
Male				12	12	24
Female				11	10	21

Source: MOE Statistics

Notes:

1. The 1995 data is for subjects recorded by level of learning rather than by year level of student. Data for other years is recorded by year level of student.
2. The data for year 10 are for computer related studies. All other data pertains to computer studies.
3. Data is for enrolments as of 1 July.

Table 14: Kahikatea High School enrolments in Typing

	Year 9	Year 10	Year 11	Year 12	Year 13+	Total
1995						
Male	25	14			4	43
Female	29	33	28	12	13	115
1996						
Male	24	14	4	1	5	48
Female	27	38	17	12	18	112
1997						
Male	35	27	9	6	2	79
Female	27	39	28	11	13	118
1998						
Male	19	29	13	3	2	66
Female	27	49	36	22	16	150
1999						
Male						
Female						
2000						
Male			5	18	3	26
Female			24	30		54

Source: MOE Statistics

Notes:

1. The 1995 data is for subjects recorded by level of learning rather than by year level of student. Data for other years is recorded by year level of student.
2. Data is for enrolments as of 1 July.

Table 15: Kahikatea High School enrolments in TIM

		Year 9	Year 10	Year 11	Year 12	Year 13+	Total
1999							
	Male	31	14	29	12	2	88
	Female	20	32	44	24	8	128
2000							
	Male	19	20		2	2	43
	Female	27	30		3	4	64
2001							
	Male	37	32	11	1		81
	Female	17	55	31	24	3	130

Source: MOE Statistics

Notes:

1. The data is recorded by year level of student.
2. Data is for enrolments as of 1 July.

Table 16: Kahikatea High School enrolments in TIM and CPS post-2001

		Year 9	Year 10	Year 11	Year 12	Year 13	Total
CPS							
2002							
	Male		19		21	6	46
	Female		4		9	6	19
2003							
	Male		32	26	34	6	98
	Female		14	10	7	7	38
TIM							
2002							
	Male	17	25	13	2	2	59
	Female	6	33	26	12	8	85
2003							
	Male	24	11	14	12	8	69
	Female	25	17	26	20	12	100

Source: MOE Statistics

Notes:

1. The 2003 data is for subjects recorded by level of learning. Data for 2002 is recorded by year level of student.
2. The 2003 subject enrolments are for the whole year. The 2002 data is for enrolments as of 1 July.

Summary

The national IT curriculum is a contestable and changeable curriculum. It is also a gendered curriculum. This is revealed in imbalanced male and female participation patterns in subjects that derive from different computer domains. The existence of a gendered curriculum is also indicated by the emphasis given to different applications and activities in different IT subjects, such as CPS and TIM. Different computing activities have been shown in international literature to be favoured differently by males and females (see Chapter 2).

National subject enrolment statistics reveal a blurring of boundaries between IT domains. This is a result of the proliferation of IT subjects offered in secondary schools in the 1990s and the

unique curriculum offerings adopted by schools. Nevertheless, there are persistent gender differences in participation patterns relating to subjects from the different computer traditions, particularly for CPS and TIM at the senior school level. Males are far more likely to engage in CPS than in TIM. Females dominate enrolments in TIM. This suggests that as a general trend there are differences in males' and females' subject preferences and hints at the existence of gendered subject cultures.

Different specialist IT subjects emphasise different aspects of computer practice or use. These differences are discernable in national subject guidelines. Both CPS and TIM can be seen to have gendered subject cultures and identities, albeit subtle, established through the appropriation of topics and applications that are traditionally associated with one or other gender – CPS with programming and male practice and TIM with text production and female practice. However, the proliferation of specialist IT courses offered in schools, variation in content and software utilised in different schools and flexibility inherent in the assessment framework means that the picture has become increasingly complex. Traditional subjectivities may or may not be maintained in any individual school context, depending on the combinations and nature of different courses offered. The dynamic nature of the specialist IT curriculum and the variation that is possible at the local level makes generalisations about the gendered nature of the curriculum problematic.

The IT curriculum at KHS is a gendered curriculum consistent with national trends. At an organisational level the existence of competing IT courses at year 12 from gendered computer traditions contributes to a gendered IT curriculum. The current staffing arrangement, with all the teachers of TIM being female and the teachers of CPS being male, does little to dispel stereotypes of gendered IT domains. Participation patterns for CPS and TIM courses at KHS also echo national trends. In the year of the field research, 2001, there is a particularly strongly gendered character to IT enrolments for the year 12 cohort, where 12CPS comprises a mixed-gender group and 12TIM is an all-female class. These patterns suggest that there is something about the subjects that are perceived as more or less appealing by males and females. This invites further investigation, both of the way that the subjects are defined in practice by teachers at KHS and of how students experience the subjects and construe them in gender terms.

It needs to be noted that the idea of gendered IT curriculum is predicated on the notion that some computer practices constitute female work, and others male work. The gendering of the IT curriculum therefore depends on what at any historical point is thought of as male or female computer practices. It is evolutionary. As ideas about what constitutes appropriate or preferred computer related work for males and females change, so will the way in which IT curriculum domains and particular subjects are seen to be gendered in practice. Changes to national subject guidelines and to the courses developed at school level may contribute to the redefinition of gender roles by enabling or encouraging males and females to pursue what have hitherto been unlikely computer practices, or act to reinforce traditional gendered practices.

The New Zealand curriculum for IT has developed in an *ad hoc* manner and is complicated in the variety and flexibility proffered to schools. The gendering of the curriculum evident at national level may or may not be reflected in the subject arrangements and participation patterns in individual schools. It is at the school level that the curriculum is implemented, where national curriculum guidelines are interpreted and courses are constructed in practice and where students experience the curriculum in reality. The flexibility and variation in the national IT curriculum provides a climate where individual schools and teachers potentially have considerable influence over the shape of the IT curriculum and thus over the culture of the curriculum, which may take a gendered form. An environment exists where individual teachers' values and views may have a significant influence on the nature of the curriculum for IT in particular schools.

The next chapter focuses on the construction of the curriculum at the local level. I explore how teachers interpret the IT curriculum in situated practice at KHS and ask whether this contributes to gendered subject cultures and a gendered IT curriculum culture at KHS. This and the subsequent chapter focus on particular teachers and students, on their actions and interpretations of the curriculum as constructed and experienced at the classroom level.

Chapter 5 Case studies: teachers' interpretations of the IT curriculum

How do teachers of the case study classes define specialist IT subjects (CPS and TIM) in practice? Does this contribute to a gendered IT curriculum culture at KHS?

At the national level information technology (IT) subjects are defined by official curriculum statements and subject guidelines for qualifications. However, it is in the organisation and design of specific courses within particular schools that the guidelines are given effect. The courses presented to students are local interpretations of national guidelines. Thus the curriculum is defined in situated practice. The content and emphasis of different courses will reflect the circumstances and historical curriculum arrangements in particular schools, and the values of teachers who make sense of the national curriculum and translate it in practice.

Culture, in a generic sense, describes shared values and ideas about what is important and is reflected in common practices or ways of doing things. When asking whether teachers' interpretations of the curriculum contribute to gendered IT curriculum culture one is probing to find whether teachers at Kahikatea High School (KHS) define or think of their specialist IT subjects in gender terms. This involves investigating whether teachers perceive different subjects to have particular relevance for one or other gender and whether the courses are designed to suit assumed interests of males or females. Do teachers interpret the IT curriculum in ways that create or sustain gendered subject cultures?

In this chapter the focus of attention is the teachers of the case study classes at KHS and the ways that they construe computer studies (CPS) and text and information management (TIM) courses – what they think is important or inconsequential in the content and presentation of these subjects and how this translates in practice. They can be seen to define specialist IT subjects according to notions that males and females have different computer needs and interests. This is not to say that the courses they create are intended to be exclusionist, nor that everything about the courses is defined in gender terms, or even that gender is a conscious

consideration in course design. Nevertheless gender emerges as an influence in the construction of the IT curriculum at KHS.

Teachers' backgrounds

Before describing the KHS teachers' constructions of specialist IT subjects it is appropriate to briefly describe their teaching backgrounds and experiences with computers. This helps to make sense of some of their ideas about what is or isn't important in CPS and TIM courses and their advocacy for particular curriculum arrangements at KHS. Whilst the staffing of the different departments that administer the specialist IT courses conforms to gender stereotypes, the personal backgrounds of the KHS teachers are unique and do not necessarily fit the typecasts of male and female expertise in different computer domains. The teachers of the three case study classes come to teaching in specialist IT classes from quite different paths.

Mr Lucas, a CPS teacher and the Head of Department (HOD) for CPS at KHS, has a teaching background in social sciences, specifically in geography and social studies. He began by teaching computer awareness as part of social studies, using word processing, database and spreadsheet applications. One could describe Mr Lucas as a grass roots teacher of CPS and a computer enthusiast. He learnt about computers and how to teach computer studies through practical experience, acquired in the process of teaching and participating in Ministry of Education (MOE) sponsored groups that were engaged to develop computer resources for use in classrooms in the 1980s. He was instrumental in the development of an applications based, general computer studies course at KHS.

Mrs Keall, the teacher with administrative responsibility for TIM courses at KHS, had computer experience associated with office work prior to becoming a teacher. She left school at the end of her School Certificate (SC) year and worked in a range of clerical and administrative positions for a variety of business and government organisations before embarking on a teaching career. Her work included accounts management, keyboarding, clerical and personnel work, data entry and supervision roles. She trained as a teacher in the mid 1990s, having made a decision to change her career path and obtain a National Diploma in Business Education, a qualification developed to upskill and train the 1990s equivalent of

typing teachers. She started teaching at KHS in 1996. Mrs Keall's work experience and teacher training is thus located within the office practice tradition of computing.

In contrast, Mrs Nugent, who teaches TIM at KHS, has an educational background in applied computing. She developed an interest in computers when working as an accountant and studied applied computing at post-graduate level. In her words this involved learning about "applications, programming, web page design, multi-media, um, networking, um_ the whole spectrum, the whole lot" (ti 6/11/01). Her background is more closely aligned to the IT industry than that of Mrs Keall. Trauth (2002) defines the IT industry as work and services pertaining to software engineering (programming), information system design and development, and information system/services consulting. In the late 1990s Mrs Nugent trained as a secondary teacher, specialising in accounting and computing. Although she teaches TIM classes, Mrs Nugent's personal experience is of different forms of computing practice than those associated with traditional female dominated roles of office support.

Course constructions

Technocratic practice

At the level of classroom practice it is apparent that CPS and TIM courses have much in common in the way they are organised and presented by teachers. The content of CPS and TIM courses at KHS overlaps. For example, word processing, databases and spreadsheets comprise instructional units in the 12CPS and 12TIM courses. These courses conform to what Moursund (1997) would label a computer-as-tool construction of IT. In this model the emphasis is on generic applications, using software to perform functions such as word processing, database management and graphical representation. These tools have applicability across disciplines.

CPS and TIM at KHS are primarily about gaining familiarity with application menus and commands, learning how to perform particular operations with the computer. They serve a utilitarian function and have a technocratic form. This is evident in the way that the teachers

present information and direct lessons. There is a similar structure to the lessons observed in the CPS and TIM classes at KHS, despite variations observed in teaching style and in the form of individual lessons.

A review of audio and video data from 12CPS lessons suggests that they typically involve a large portion of time whereby students work through activities designed to introduce the menu functions of different programs, to practice using these and apply them to problems or scenarios described in activities. The activities are incremental in nature, building on what was learnt in previous tasks. The students work through a series of task sheets and assessment activities. Lessons observed that marked the beginning of new units, such as the introduction to spreadsheets (ob 15/5/01) and introduction to programming (ob 21/8/01), have much more direct teaching than subsequent lessons. In these introductory sessions Mr Lucas instructs the whole class on new material and works through initial activities with them. In contrast, later lessons are primarily workshop sessions, where students settle immediately to work on activity sheets upon entering class, picking up where they left off in the previous session and having work checked by Mr Lucas as they complete different sections. For example, in the spreadsheets unit the instructions require students to show their work to the teacher before clearing the spreadsheet; specified sets of work need to be saved and printed. In a number of lessons observed Mr Lucas spends a portion of the period handing back work to individuals and providing feedback about whether the instructions were followed and requirements met. Sometimes the teacher interrupts the class to explain a procedural point to the whole group, usually when he senses confusion with an activity. Interactions with students tend to be of an instructional nature – the teacher telling the students how to perform particular procedures in response to queries.

Similarly, 12TIM lessons take an incremental and technocratic form. The six lessons observed are part of a unit of work on databases. The business of the lessons is the interrogation of database information using tools for queries and the creation of forms. However, due to the large number of student absentees, because some students are away from school on childcare placements, Mrs Keall changes tack in the later lessons observed and provides class time for students to work on their research assignment. This involves the production of a brochure or

newsletter on a topic of the students' choice. Time is also given for students to re-sit unit standards assessments and perform keyboarding speed tests.

The general lesson structure is similar to that observed in 12CPS, although in the particular 12TIM lessons that are observed more time and emphasis is devoted to whole class instruction relating to new procedures. For example, in the earliest of the 12TIM observation lessons the teacher instructs the class to open an existing database in the pool directory and to "play round with moving within the table" (tc 6/5/01), moving between fields, and to add new records, only to find that students can't do what she intended due to a problem with the Form Wizard software. She changes approach and explains what forms look like, how to add records using forms, and how to run queries, including some with mathematical formulae. Step-by-step instructions are provided in whole class instruction and students follow the procedures to learn the new techniques. The teacher continues to be frustrated by problems with the software for generating forms and with approximately ten minutes to go she directs students to work from alternative activities in the textbook. In subsequent lessons less time is taken up with direct teaching/instruction episodes and students work independently for greater periods of time on a range of activities that familiarise them with software functions and provide practice at producing and interrogating databases.

The majority of lesson time in 12TIM is given over to students working independently on activities, with the teacher circulating around the room to provide assistance to students. The students work through a series of tasks, with some working faster than others. Much of the discussion and instruction is of a "how to" nature. Students follow the steps and procedures outlined by the teacher in whole class and one-on-one instructions to produce different types of documents. Learning activities comprise worksheets created by the teacher and activities from a class text (Main & Barton, 1999a). These provide a series of sequential, content and skills building activities related to different applications. A range of scenarios or problems is described in the activities for different units. For example, in the database section students work through a range of activities set up for pseudo businesses, such as the creation of a movies database for a video rental outlet and of an accommodation database for a public relations office. Typically the activities require students to create fields, input information, create a form, locate information and provide a report. Subsequent activities introduce new

skills, such as searching for records, conducting queries and creating a relationship between tables. The 12TIM textbook provides the “how to” guide and performs a similar function to the task sheets in 12CPS. Students are introduced to new functions and menu operations as they work through the activities. They learn the language, rules and procedures of databases. This is a technocratic construction of learning in 12TIM.

The situation is similar in 10TIM. As in the senior school, learning in 10TIM is constructed as technocratic practice. Mrs Nugent typically begins a lesson with an instructional episode that introduces or reviews the software functions or menu options and students are then directed to work through activities on worksheets that use those functions, such as writing and formatting letters or creating a poster advertising reading week. For example, in one lesson (sc 4/5/01) Mrs Nugent begins by recapping on the previous lesson regarding the use of heading and paragraph styles then sets students to work copying a paragraph and applying different styles. In another (sc 24/8/01) she provides step-by-step instruction early in the lesson on how to use a new application, called My Computer, to manage files, which students act on as she speaks. They then work independently on one of their files.

Thus, the specialist IT curriculum at KHS is constructed in practice as a technocratic curriculum. However, the subjects that are presented to students have a unique character. They are given unique form in the emphasis provided to different course components and the value that teachers place on different practices and aspects of the CPS and TIM courses.

CPS constructions

Three dominant discourses emerge from teacher talk and action pertaining to the construction of the 12CPS curriculum in practice: CPS as basic skills; CPS as individual endeavour; and CPS as IT/information systems.

CPS as basic skills

12CPS is designed as an introductory computer course to provide students with basic knowledge and skills to use a range of applications. It has a practical orientation. The 12CPS

course at KHS is structured in a way that emphasises hands-on use of computers and mastery of software applications.

Students are required to work through a series of units or modules on different applications – word processing, databases, spreadsheets, integration, programming and theory – in that order. The rationale for this sequence of units is that students learn most effectively through practical experience.

GL (Mr Lucas): ...But we leave that [theory components; unit standards 2780, 81 and 82 on how computers work] to the end of the year, simply because most of it the kids have learnt by doing all the other stuff. If you know what I mean. You don't have to show them how to start up and shut down and, and save into files and folders and things like that coz you've been doing it all year. So it's a matter of assessing them against that and reminding them why they've done it. (ti 1/3/01)

Within an individual unit, students are required to complete a series of worksheets, or sets of activities. These get progressively more complex and build on previous activities.

GL: And they just simply start with a basic part. Then each exercise tries to introduce one or two new aspects of that particular, um, function. You know, um, the first database we are just simply setting up filters. And then the second exercise was setting up the records and doing some filters. And then the *third* one was setting up, um, the database, doing some filters, adding new information and then printing a report. So you are trying to extend. And then we have got calculated fields added in, where they actually have to use information that was there. And that is when it starts to lose some of them, because you are now moving into areas where they think, "Well, hang on, how can I do that?" And they have got it, and you explain it to them, show them the notes, and again, if they don't keep doing it. By the time you get to the last exercise they should have, by repetition, done each of the things, so that when you test them they should be able to do it... (ti 11/5/01)

The structure of units is consistent with a skills development model, where practice, repetition and incremental exposure to more difficult or complex components helps students to develop greater skill at using different computer applications. The desired end is for students to be able to use a range of applications to process data and produce reports in the integration unit.

GL: ...They have to create a series of reports and they are given a series of tasks. I'd set up a database to do this, set up a spreadsheet to do this, um, write this material, bring in a, um, some information from the database, a filter, bring in a graph, bring in a table, and they have to set it out. And that's putting it all together [integration], and that really does sort them out. (ti 11/5/01)

Year 12 CPS is conceived as a broad familiarisation course that is thought to meet the needs of a range of students. Mr Lucas describes 12CPS as a course that provides particularly for students of limited academic ability and those with limited English language skills.

GL: Yeah. Basically they are doing Sixth Form Certificate computer studies. I don't think there is any very *able* kids in the class. Um, most of them are middle of the road, um, and that's what the course is geared at. It's geared at kids that, um, possibly got at least one School Cert subject, but maybe not even that. And then there is a group of internationals that is in there because it is an area that they can actually improve their English and they can cope with, because its direct follow-your-nose, do this do that. There's not a great, because most of the internationals are good-written, or reading English skills, but poor comprehension and vocal when you are talking to them, but they can read it and make sense of it most of the time. (ti 11/5/01)

The workforce is the assumed destination of most of the 12CPS students on leaving school. This assumption provides a rationale for the construction of CPS as a basic skills course. It is primarily thought of as a course for non-academic students – with individual exceptions, such as Mason, Ben, Joanna, Carl and John, whom Mr Lucas thinks will go to polytechnic or university.

R (Researcher): ...Where do you think *most* of the kids from this class are going? I get the sense from what you have said that a lot of them are sort of destined for_ work very shortly.

GL: Destined for the workforce. Yeah. They will go into jobs, um, straight from school. Very few of them will go on to university. Um, a few will go on to Polytech, but the vast majority will go out into jobs where they will be_ um, using computers hands-on. In_ some a bigger effort than others. But most will use them somewhere and suddenly realize what it was all about.

R: Are you thinking in terms of, like_ office support jobs_?

GL: Well they could be. They could be anywhere. But they can go into industry and still have to work a lathe with a computer pro_ component to it. And they will still have to key in information and all that. So it's, it's, to me it's all one big thing. If you haven't got confidence of using the thing that, what you've, you've followed the instructions, um, you know, that's half the battle. People say, "Oh, I can't do that. Can't use that." But you can.

...

GL: Yeah, they [John and Carl] may end up at Polytech but I suspect they will be going into, um_ probably graphics rather than [computer science]. They may end up in computer graphics. (ti 11/5/01)

It is hoped that 12CPS will increase students' familiarity with computers and give them greater confidence to use them in a work environment. Thus there is a vocational motivation to the development of basic computer skills in 12CPS, although it is constructed as a general course and students are not being trained for particular jobs.

Computer studies has traditionally held the position of practical, applications based, skills oriented, introductory computing courses at KHS. Mr Lucas explains that when CPS was introduced at KHS in the late 1980s it was one of a cluster of courses created to provide an alternative to academic subjects for students in the senior school. The year 12 and 13 CPS courses are maintained as practical subjects in 2001. Theoretically, academically oriented

students can and have always been able to take 12CPS, provided that it does not clash on the timetable with academic subjects that they give higher priority in their subject choices. Entry to CPS courses is not restricted to students deemed to be non-academic. However, CPS constitutes a practical rather than a theoretical or abstract subject offering.

The basic skills construction of CPS reflects the historical status of computer studies in the national qualifications structure. Mr Lucas signals that to date the school has had nothing to offer students who want to pursue IT studies at university because CPS is not a University Bursary (UB) subject. The assumption is that students who are seeking entry to university are unlikely to take CPS courses. Consequently, the computer studies department has chosen not to place greater emphasis on programming in 12CPS, programming being a feature of university computer science and perceived as academic computing. This may change, though, as National Certificate of Educational Achievement (NCEA) is introduced and takes the mantle of the mainstream national academic qualification and as the content of the 12TIM and 12CPS courses is re-negotiated at KHS.

CPS as individual endeavour

Year 12 CPS is organised in a manner that encourages individual and independent work, based on a series of work sheets for each unit. Such an emphasis is perhaps inevitable, given the assessment imperative of Sixth Form Certificate (SFC) and the perceived need for teachers to confirm that individuals have earned the grades awarded for internal assessment and the authenticity of their work. However, assessment requirements do not mean that all of the course must be presented in an individualised fashion. The fact that it is implies that this is considered an appropriate and desirable way of learning about computers in 12CPS.

It is expected that students will work at different rates in 12CPS, which is catered for overtly with the inclusion of extension activities in several units.

GL: And it's, it's, there are a series of units. Now, the next_ with spreadsheets there is some work at the end where they don't have to do it all and then when we get to integration again there is some extension there. So we didn't worry about it on the first two [word processing and database units], because we tend to keep them as a group there, then they start to spread out. (ti 11/5/01)

And

GL: Well in terms of computer studies we've found that if you want to extend the few good kids that you have you've got to actually keep feeding them work so, um, you tend to have a few sessions where you talk to them as a group at the beginning and then after that it tends to be individual kids. As they hit certain exercises you explain to them what you want, go over the background to it, and then away they go. Now, um, that allows them to work at their own speed. Now there is a set number of exercises they have to get through and in some units there is an extension. Normally each one of them has got one exercise at the very end which doubles as a test, which extends them. Like for, um, word processing it is a two page news sheet where they have to find the information and lay it out using all the skills they have developed, and the good kids use all the skills. The other ones just type up a few things, increase the size, double space it and pretend that that's going to meet the requirement. And it doesn't. And all the requirements are spelt out. They have got to use so many fonts, so many --- and, you know, they just don't *bother*. And it is the same with the database. They have to create their *own database* and they have to create their own exercises, work them through and come up with the answers. Now, that allows the good kids to do a *good* one because they speed up, get some more time at it. The ones that, um, are just filling in time, they reach there and then they do the minimum effort again. (ti 11/5/01)

In fact, as revealed in the above excerpt, speed of work completion is taken as an indicator of ability and success. The “good kids” achieve well because they get more time at activities. Thus, subtle rewards exist for those who work quickly. Completion of extension activities acts to prove the faster students’ superior ability. Those who get up to these questions are observed to meet with teacher approval. Also, some lenience is allowed for students who are ahead to do different things, including playing computer games on occasions. Conversely, subtle sanctions are observed for those who are behind in their work, such as failure to complete some tasks or assessments and exclusion from whole class teaching relating to a new topic, as evinced in the following excerpt from teacher instructions to the 12CPS class.

GL: ...Now I want to move on with some people [to whole class] and it just means that those people that are behind are going to stay behind and get further behind if they don't start catching up. All right? As far as I'm concerned anything on integration that's not finished by Friday, that's it. Doesn't get marked.

...

GL: Yeah but it's three periods to do that assessment. All right, now look [addresses whole class], for those people that I've just given a bunch of programming notes to, you're the only ones that need to listen. The rest of you carry on and finish what you're doing. Coz that's the reason you're not on it. All right? So get it finished. Then we'll have to explain to you separately... (tc 21/8/01)

Analysis of this excerpt reveals a tension between competing teacher motivations – a drive to move on to new work and recognition of individual students’ needs for additional time to catch up or complete work. However, there is a sense that those who need extra time are in some way inadequate. The tone is accusatory. Responsibility for not being finished lies with the students. It is implied that through their own actions they are behind. This may well be a fair judgement of some individuals, who do not use their time constructively in some lessons

observed and who miss class on occasions. I witnessed such events. Nevertheless, there appears to be no questioning the assumption that fault is with the individuals or consideration of other factors, such as pedagogic practices, as possible influences on students' achievement.

Work completion is presented as an individual responsibility. There is an expectation that students will finish work outside of class time if they don't meet completion targets in class. This may mean using the computer room at other times, or in some instances doing the work at home. The following interview excerpt illustrates how work ethic, speed and precision are linked in Mr Lucas's thinking as factors that contribute to the success or otherwise of students in 12CPS. There is a sense of frustration at the lack of motivation and care taken by some students (Zara and Kevin), which is contrasted with the attitudes and application of those who are seen to do well, relatively speaking (Rick).

GL: ...Zara is just not here at times. Yeah, um, Rick Smith, um, he wants to go on full time job search. He seems to one week wants to and the next week he doesn't, so_ ah, they still have the attitude that, um, you just come to school and you don't have to do anything. And that's_ They will fritter away the time and then complain they are behind. Um, so, that's where they, and as the year goes they get further and further behind. And that's what sorts them out at the end. You don't have to have difficult work. The good kids will get it finished and get maximum marks. The next level of kids will get *most* of it finished and lose a few marks and the ones at the bottom that will get the 7s and 8s are the ones that don't complete work. You see you take Kevin, for example, he could cope with it quite easily, but he had two days sick then he had 3 days off with stage challenge so he missed a whole week of work. Now he's made no effort to catch that up. And so he will always *be* that week behind, because he has no_ *concept* of having to extend himself to work hard to catch that work up. He will just say, "Oh, it's not my problem." And that is the action of a large number. "Oh, it's not my problem." And they can't see *why* I can't see why I can't just give them a mark because they weren't here, they were sick. You know, you've got to catch_

...

GL: ...Now, you see, Rick Smith got behind so what he did was he did, he did it all at home, on his PC at home. Now that's fine. He could print it out there. And we converted the database today from a PC format to a Mac format. And he's handed it in. Now he caught up at home_ by doing it that way. Now they can do that if they want to, or they can go over there [computer room] in study period. You know. They just simply use the key that you [researcher] borrow. You know_ they commit to give it back. Um_ and they can borrow that and go up there and catch up on their work no trouble at all, if they want to. But again, it's the motivation, and, yeah, over the years its got less and less. (ti 11/5/01)

This excerpt presents a picture of what it means to be a successful student in 12CPS. A proficient student has the skills and attitudes that predispose him or her to work independently, is self-driven and has the interest or motivation to complete work outside of class time. They have an independent work ethic. Implied in the above description is the notion that if a student doesn't complete work he or she must have been wasting time. These students are positioned

as deficient in their attitudes. The emphasis on individual work means that it is a simple step to assume that lack of success is a result of lack of effort by individuals.

In this independent learning model it is held that students will learn if they just work through the practical activities in the order presented. It is assumed that students will be able to understand the instructions in task sheets and accompanying notes. Such an assumption is evident in the following excerpts, both taken from conversations between Mr Lucas and international students in 12CPS.

GL: It's all in your notes [GL straightens up and moves towards Xiao-hong]. It's all in the notes you were given the other day.

D (Donny): Yeah_ [GL moves back towards Donny, picks up notes sheets and points to relevant sections; sound of shuffling paper] Oh OK.

GL: --- Rearranging columns and rows. Um_ Cut to delete rows or columns. Clear cells. It's all there.

D: Oh OK.

GL: Have a read of it sometime.

D: Thank you. (tc 18/5/01)

And

GL: I know they are not on there but I did ask you to print them out. You need to finish that and you need to finish that. Now I want three reasons why you have set up a database. Now they are to do with the nature of why you use a database. What is a database basically?

Q (Quentin): Um

GL: What is it?

Q: ---

GL: Well if you had the notes that I gave you at the beginning and actually read the first page, it told you everything you needed to know. (tc 18/9/01)

The teacher's tone in these two excerpts is one of controlled irritation that these students haven't read the notes. The assumption is that they haven't bothered to read, not that they find the notes difficult to understand. It is believed that the computer procedures are clear if only the students read the explanatory materials.

Mr Lucas describes the 12CPS course as pupil focused, by which he means that students are engaged in independent, self-paced work and that students are left to work through the activities with less teacher input than might be expected in other subjects. The primary

classroom relationship described is that between individuals and their computers and not in the social relationships between students and their teacher or peers.

GL: ...It's a completely different way of teaching than teaching geography and social studies. It's [computer studies] very much a *pupil* centred, whereas the other one it tends to be *teacher* centred.

R: Can you elaborate a little bit on that. When you say pupil centred, what do you mean by that?

GL: Well, whether it's just, I don't think it is unique to us, but it's one where you have got to allow the kids to move at their speed, so you have to have units of work which the kids can follow_ and_ can work from. And they work then at their speed with a little bit of pushing, because you can't let them go too slow. But you have to actually have to have the units which the kids work *through* with the machine. Whereas, um, in something like geography or social studies, where there is a lot of interaction between people, you have got to have a teacher there directing the groups, either working them in groups in half a dozen or so where they can get some talking, or it's a conversational base thing where you are discussing something. Whereas computing, you are really you and the machine to solve a problem. Here's the problem. This is what you got to try to learn to do to solve the problem. Try this. And then the next problem you assume they have learned from the previous one so that you only introduce *one* new thing each time you change the problem. And after they have worked through a series of problems they should have the answer then to any spreadsheet problem. Here's the problem. Design a spreadsheet to fit it. And that's the way the, the work progresses, so that you give them a fair amount at the start. Then you only give them the new thing they need, after that, and they have got to go back and_ So it very much is the student finding on their own, with the minimum of help from the teacher. The teacher is there to *help*, not to *tell* them how to do it.

...

GL: ...if you are teaching students how to use a computer they must be using a computer. Therefore it becomes very much a one-to-one to the machine. It is the person operating the computer. And they have to make that computer *do* what they want it to do. And so it is very much learning that skill. And so, it, it's a bit like learning sewing. If you don't learn the sewing machine how are you ever going to learn it? Coz you actually have to make the garment. And it's the same thing. You have to *make* the computer do it, and the only way you can do that is to go through the trial and error, the problem-solving, which is what it is there to do. Um_ while you are solving problems in a social science you are actually dealing with people, and people are not as predictable as computers. Therefore you have to come up with a lot of, um, alternate scenarios depending on what group of people you are dealing with.

R: So is it fair for me to say that, say in social studies or something like that, that the machine is there but it is more peripheral?

GL: Yeah. It's to *help* you solve something, rather than the, the end-all of it. You are using it as a means to the end. Whereas in computing you are actually using, (have) to use the machine better and more efficiently. If I'm using it in geography I'm using it to expose the kids to facts. Um, they can get them off the Internet. They can get them off a thing, ah, MacGlobe, which has got statistics about countries. And then we go and use that information to explain something else, but the computer doesn't have anything to do with that. It's just the source of information. The Internet is just the *source* of information. You must *process* the information, otherwise it is meaningless. Whereas if you are doing a spreadsheet it's an end in *itself*. It is solving a problem by using the computer, and in the end it will work. So, yeah. (ti 19/11/01)

Mr Lucas feels that learning about computer technology is different to learning in conventional classroom situations. The materiality of the computer classroom is taken as a pedagogical determinant – because students are learning about computers it is desirable that

they work independently with the machines. The suggestion is that a teacher is a different person when working with students in a computer classroom, meaning that he or she is required to act in a different way than in other classroom situations; also, that there is a requirement for students to act in different ways when learning about computers than when learning in other subjects. Mr Lucas implies that there is a responsibility in conventional classrooms for the teacher to be flexible and to engage with students in a way that fosters debate. By implication discussion is less relevant in a computer environment and teachers do not have the same responsibility to engage students in discussion in a computer classroom. Computers are viewed as predictable and non-problematic objects of study compared with people. Learning about and with computers is a matter of “doing it”. There is little room for social interaction of a discursive nature between peers and/or teacher and students in the computer classroom. By implication, social interaction is appropriately confined to one-to-one consultation on matters of procedure. This is an instrumentalist way of thinking and viewing teaching and learning in CPS.

Observations of lessons support the impression that individual endeavour and independent work is favoured in 12CPS. In an example of a fairly typical lesson (ob 18/5/01) the students arrive and get settled at their computers. Mr Lucas arrives with the students. He issues a reprimand to Kevin for inappropriate noise then proceeds to get organised for the lesson, sorting papers at the front of the room. He briefly instructs the whole class, outlining the activities for the day and sets a time frame for work completion. Mr Lucas then organises individual students into different tasks, which relate to the final database activities or the beginning of the spreadsheet work, depending on their current levels of work completion. He circulates around the room, handing out database test papers to the students who need to complete them during the lesson, fielding questions and reprimanding those who appear to be off-task, such as Scott who is loitering at the front of the room. Much of the lesson is spent responding to queries from individuals. For example, Joanna seeks confirmation that she has met requirements for the individual database activity. Ben seeks assistance when his mouse doesn't appear to be working. Ling-ling asks for help to input formulae in a spreadsheet. Donny wants to know how to justify a column of figures. Mr Lucas tells the students what to do and demonstrates appropriate procedures. The large majority of teacher-student interactions are work related and of a procedural nature. However, at times Mr Lucas acts as counsellor

and school administrator, advising students on non-work matters; he also acts as a technical trouble-shooter and assistant, for example, collecting and loading printer paper when it runs out.

In other lessons, as in the lesson described, the emphasis is on establishing and maintaining an environment where students work individually, focusing on their computers for the duration of lessons. Mr Lucas controls the physical space of the classroom, circulating constantly and returning to the middle of the room to survey classroom activity when he is not engaged with individual students. The established routine for students wanting assistance is for them to put their hands up to signal need and wait for the teacher to come to them. Rarely do students get out of their seats or physically move to consult with the teacher, although some do. Mr Lucas tends to work systematically along a row before moving on to a different part of the room. Frequently neighbouring students will tune in to an explanation given to a peer and take the opportunity to ask the teacher questions of their own. Seldom are students instructed by Mr Lucas to consult others in the class. However, they do this voluntarily, asking those nearby for help. Such interactions have the tacit approval of the teacher, who allows such interactions. However, structured peer teaching and student-student interactions are not actively encouraged.

It is apparent, then, that the 12CPS course is constructed in practice in a way that emphasises independent work. The emphasis on independent learning in 12CPS is consistent with Mr Lucas's personal self-taught experience with computers. He assumes that by working through the prescribed activities with the computer, with whatever supplementary instruction is given to the whole class or advice given to individuals, students will learn what they need to know and be able to fulfil course and assessment requirements. This does not exclude interactions between students, or consultation to solve problems, but places high value on individuals' abilities to work systematically through activities, from written instructions and notes, and to pace themselves in order to complete the requisite tasks within an established timeframe. Thus learning about computer studies in 12CPS is a matter of individual endeavour and primacy is given to interaction with computers rather than with people.

CPS as IT/information systems

In the context of discussions about plans for the future of 12CPS, Mr Lucas signals that adjustments will probably be made to course content to maintain a distinction between 12CPS and 12TIM. These adjustments constitute a move towards an IT industry orientation, particularly in relation to programming, web authoring and network systems.

GL: Yeah we, we see some major changes coming through because we want to move away from some of the things we *have* to do, because of the Sixth Form Certificate, that we don't have to do. We won't have to do word processing if we don't want to. We can create a course that is, yeah, more programming or more, ah, based on web site. That sort of stuff. More IT stuff, which they don't do in the TIM. (ti 1/3/03)

And in a similar vein

GL: But as far as computer studies is concerned, we would like to keep the subject going at year 12 and year 13 from the unit standards side. We would drop the word processing once the Sixth Form Certificate_ goes, coz then we don't have to follow that. We would like to keep the spreadsheet and_ database because I think we use it to a greater depth than they do in the information technology, which is, or the technology, which is coming in. And also we would use the desktop publishing, and we're moving into, ah, web page design, and also the units [unit standards] about using the computers, developing, um, network systems, that sort of thing, which will take us into level 2 and 3. We are currently using 2 and 3 [unit standards]. We have even got a level 4 one that we are looking at, coz we can go up to the end of level 4. So we are steering away more from the, ah, the old commerce image of it and looking at how does the system run, which is what we find a lot of the students want to go into. They want to go into network systems and they want to go into *programming*. So we are *edging* closer and closer to more programming, and that's where the spreadsheets especially, because there is a lot of overlap between the commands in spreadsheets and the commands in the, in the programming. And that will be the direction that we are moving in. How to, operating a computer, operating a system. (ti 19/11/01)

A move to incorporate more programming and content relating to computer systems, and to remove word processing from 12CPS, would give greater separation between the content of the two applications based courses at KHS and maintain the identity of 12CPS. Word processing is closely associated with an office practice image of computing and dropping this application from 12CPS would provide a key point of difference between the 12CPS and 12TIM courses. The exclusion of word processing and added emphasis on programming and computer systems would position CPS at KHS more closely within an IT industry construction of computing practice. Whilst the course would retain an applications focus, the selected applications would be more relevant to training and work in the IT sector and to tertiary computer science.

Mr Lucas's comments also reveal that he perceives a qualitative distinction between 12CPS and 12TIM. He thinks that 12CPS is more difficult or challenging, and that the assessment structures provide greater depth of understanding and familiarity with applications. He implies that by focusing on the applications that are more closely allied with IT/information systems the students of 12CPS will be advantaged.

GL: ...We'd like to try and get it to be different. We will do database and spreadsheets according to the unit standards, which are a little more in depth_

R: Yeah.

GL: Coz, coz the TIM one, is my understanding at the moment, is only going to be a, almost a superficial_ touch into it. It's not as, as in depth as we are doing at the moment. (ti 1/3/01)

One gets a feeling for what Mr Lucas considers to be important aspects of the 12CPS course from what is identified as less important. The development of keyboarding technique is something Mr Lucas sees as incidental to computer studies.

GL: Yeah. So, and again, you know... we, we've always put an emphasis on, um, what the computer can do rather than the keyboard.

R: Yeah.

GL: You know. I've never insisted on kids actually use the right fingers and all the rest. Whether I'm supposed to or not I don't know, but it didn't really worry me. As long as the document that come out is, is good. And that is when they start to speed up after a while, once they start using their fingers more widely. But you start off with kids still picking [mimics two finger typing] _ but, you know. (ti 19/11/01)

In the above excerpt indirect comparisons are drawn between CPS with TIM. There is an implicit criticism of TIM and its keyboarding component. Year 12 CPS is described as superior because it places less importance on typing and greater emphasis on the information processing capacity of computers. Mr Lucas doesn't necessarily think that keyboarding skills are undesirable, but that they are not of particular importance in CPS.

The teacher of the 10TIM class, Mrs Nugent, also makes a qualitative distinction between CPS and TIM. Her personal education and background in applied computing appears to dispose her to favour courses with an IT/information systems connection. She gives the impression of being careful not to criticise the construction of TIM at KHS, while at the same time signalling that she considers CPS to be more intellectually challenging because of its association with IT/information systems. She comments that her computing background is "quite far removed

from what I'm teaching in a TIM class" and indicates that she would rather teach CPS if she had the opportunity (ti 6/11/01). She implies that CPS is more specialised and provides better preparation for careers in the IT industry.

CN (Mrs Nugent): Um_ The prospects if you're taking text and information management, I s'pose, are something like clerical, that type of thing. Um, taking the option of going into computer stuff, computer studies. IT it's a, it's a huge field now. It could be systems support. It could be network support. It could just be, you know, maintaining p_ whatever. It could be many ways for them to go. And that, that would be going more into the computer studies direction, I think. Mmm. (ti 14/3/01)

And

CN: I'd like to think that computer studies did develop, because we_ we find that as, as students come in at year 9 their knowledge and level of computing is higher than maybe two years prior to that, so to try and keep up with their expanding knowledge both of the subjects have to move, but I see computing moving into a more specialist area, for those who specifically want to go into maybe IT, something like that, ah, and TIM I see as a tool for doing something else. Um, maybe for_ anything, creating a database specifically for something, or a spreadsheet to record something. Yeah.

R: You said about computer studies going into something more specialist. Can you elaborate a little bit? Are thinking particular types of applications there or_?

CN: Yeah, maybe going into some_ a career in IT, maybe web page design, or network maintenance, um, network admin. Something like that. The people that are specifically going into work in that field, rather than people who need computing skills and may go into many, many, many different fields.

R: So is it fair to say that you would see computer studies as being more technical? Is that an appropriate word or not?

CN: Um_ maybe not technical. I would probably use an example of a database. Probably in TIMs we would teach just, ah, a single table flat file database, um, but in computer studies you maybe go in and teach how to actually create a relational database with links between tables and that sort of thing. Maybe it is just a higher level. Yeah. (ti 6/11/01)

There is a tension, then, between the historical position of 12CPS as a general introductory computer course and the expressed desire to move towards an IT industry construction of CPS that is more closely associated with computer science. The effect of creating a broad, applications based course at the inception of CPS at KHS has been a move away from a mathematical (programming), computer science construction of computing. Nevertheless, the inclusion of programming in the course helps to give 12CPS its unique identity and offers a point of distinction between it and 12TIM. The advocacy for an IT/information systems construction of CPS is part of a move to provide academic legitimacy and a discipline base for the subject. There is a tension between academic and vocational or practical constructions of

computing that are being worked out in practice at KHS. What constitutes basic skills for students of CPS is being redefined.

The internal curriculum politics of KHS and national curriculum changes are forcing adjustments to the 12CPS course at KHS. There is clear concern to maintain distinct domains of practice, and along with this the interests and/or jobs of teachers in these curriculum domains. Interestingly, the teachers at KHS are responding in a way that moves 12CPS towards a computer science image of computing, which is a construction that has been resisted historically in the practical, computer-as-tool construction of CPS at KHS.

TIM constructions

The dominant discourses in teacher talk and action that define TIM are: TIM as a utility subject; TIM as office practice; and TIM as creative practice.

TIM as a utility subject

Like 12CPS, 12TIM is constructed and presented as a course to familiarise students with a range of commonly used applications. It is formulated as a general, utility course. Students of TIM are portrayed as users of computer technology, rather than as technological experts who create and control computer systems.

Mrs Keall is at pains to emphasise that 12TIM provides tools for students to use in a variety of work and life situations. She anticipates that students of TIM will utilise computers in a range of contexts, but she doesn't foresee the girls going on to pursue careers in the IT industry – or at least this isn't something that she mentions in conversation.

AK (Mrs Keall): Some of them are probably destined for working in a office environment. Um_ a lot of them have got other subjects that they want to do. There are quite a few of them in there that do Hospitality. A couple of them want to be chefs. No, no I don't actually see them destined to be in an office, as such. Um, I think some of them, there are a couple in there that will probably go to university, and I think they see that the skills are quite important for them to transfer over into their assignment work, and that. No, I don't think they would be all destined for offices at all. (ti 21/8/01)

She anticipates that 12TIM will continue to focus on general purpose applications in moves to differentiate the TIM and CPS courses at KHS.

AK: Um, they [12CPS] are already thinking of doing things like web page design and that type of thing, and going that way, and the programming. Whereas we [12TIM] are probably_ (it's just) the spreadsheet and the database and the word processing more, and see if we can make two distinct courses, I think. (ti 21/8/01)

Mrs Nugent similarly sees TIM as a general course for computer users, which contrasts with the specialist computing construction that she places on courses from the computer science tradition.

CN: It's a dynamic subject. It's developing all the time, so it is really hard to say maybe in five years, because the lifetime of computing is a lot shorter than that, or an aspect of computing, so_ um_ I imagine myself TIM will remain teaching people computer skills to use as a tool and computer studies will just get more specialist, and_ um_ Um, there seems to be a need for creating IT people, and I think that [specialist IT schools/institutions] will meet those needs and the TIMs classes meet the needs of those that just want to dabble with computers and become computer literate rather than specialists. (ti 6/11/01)

In describing TIM as a course for those who “dabble” with computers Mrs Nugent implies that TIM is of lesser status or importance than is CPS. Text and information management is for those who are less serious about computing, rather than those with serious intentions and vocational interests in the IT industry. Text and information management is portrayed as less sophisticated computing. Mrs Nugent is of the opinion that to date the level of IT knowledge that is presented and acquired in TIM courses has been fairly low. This is attributed to a lack of previous experience of students who enter TIM classes. However, this situation is thought by Mrs Nugent to be changing as students acquire computer experience in a range of settings and prior to secondary school.

CN: I think the more experience or the more, um, that they are, you know, the more experience they have on different packages I think the better off they are. And particularly now we're finding that probably what we were teaching in year 12 or year 11 is now moving down. You know, the depth of knowledge that they are coming in with at the beginning is greater and it's quite interesting to see now. (ti 1/3/01)

Whilst the different backgrounds and responsibilities of Mrs Keall and Mrs Nugent lead them to view TIM differently – Mrs Keall exhibiting pride and enthusiasm for the courses she has developed and Mrs Nugent being more reticent in her judgement – they are united in construing TIM as a utility subject with applicability across a range of disciplines. This construction of TIM positions computers as information processing tools and students as the users of these tools.

TIM as office practice

A prominent construction of 12TIM at KHS is that of TIM as office practice. This derives from the commerce and typing traditions from which TIM has emerged and is preserved in the aspects of the SFC course guidelines relating to the input and manipulation of text. What is interesting is the extent to which 12TIM is identified with office practice, with secretarial or clerical functions, despite curriculum developments that broaden the scope of TIM and include a range of computer functions, including spreadsheet, database and Internet browsing applications.

The teachers of TIM associate the subject with clerical work.

CN: The prospects [for work] if you're taking text and information management, I s'pose, are something like clerical, that type of thing. (ti 14/3/01)

Mrs Keall promotes the idea that 12TIM is far broader and more exciting than previous keyboarding courses. However, when providing examples to students of how particular applications are relevant in the workplace she tends to use clerical examples. For example:

AK: [to Angela] OK? So when you see someone in a, um, business, and you come in and they start keying in your details, they're using a [database] form. So they're typing in – Angela? Tab. Gainger. Tab. Address. Tab. Suburb Tab.

A (Angela): Oh!

AK: OK. And that's how – that's what they're using to enter it straight into. And actually going straight into a database they're using the form to put your name in.

...

AK: [to F?] So one day when you go out there in the big world, and they want you to design a form, you'll be able to do it. (tc 7/6/01)

Thus, 12TIM is presented as training for office or related work, in the use of applications for the creation and maintenance of business records. This is despite recognition by Mrs Keall that most of the girls in 12TIM will not go into office work and that some are destined for university. However, the office practice construction is consistent with Mrs Keall's background and experience working with computers. Her personal interests and experience appear to be particularly influential in the way she has constructed the curriculum in practice and represents TIM in the classroom context.

Observations in class suggest that keyboarding skills may have greater prominence in practice than the 12TIM course outline and Mrs Keall's interview responses suggest. In one week during the classroom observations the students are required to perform keyboarding speed tests, which earn credit for unit standards. Speed tests are set at different levels, each specifying the number of words per minute that must be achieved and the number of errors allowed for each speed level. Typing skills are thus given a place within the enacted curriculum and assessment structure of 12TIM. Although Mrs Keall downplays the importance of keyboarding in discussions of the course outline, keyboarding skill is presented as a small but significant feature of the 12TIM assessment programme to students, something that allows them to accumulate credits towards NCEA.

AK: [addresses class] Now these, um, speed tests are only worth one credit. But they all add up.
(tc 28/6/01)

Also, there is a theory component in the 12TIM course that relates to ergonomics; that is, good or safe keyboarding practice – including placement of fingers on keys, posture, seating and computer position. Even though typing skill is not emphasised by Mrs Keall in interview comments and explanations of the course and assessment structure it is apparent that keyboarding practice is a feature of the assessment profile and of the 12TIM course in practice. In fact, the year 12 TIM course is described as a “word processing” and “typing” course in the Senior Course Book. The specified entry prerequisite is 50% in year 11 typing or HOD approval. Thus, 12TIM is firmly aligned with a typing tradition.

Keyboarding skills have traditionally been valued as qualities of good secretaries. In conversations with students, Mrs Keall signals that these skills are desirable and marketable commodities.

AK: [to F?] OK. So you're probably sitting around about 33 words per minute roughly. That's OK. It's something to aim for. Another couple of words per minute isn't it? That's good. Gives you an idea whereabouts you are. And when you're filling in your CVs you probably – if you're going for a particular job, you'd probably say, definitely, that you're a 30 words per minute. If you've only got that much to go at the end. All right? So you can put that on your CV. (tc 28/6/01)

The assumption here is that students, or at least some of the students in 12CPS, will be seeking jobs that require traditional typing skills. Mrs Keall also reveals in an interview that she values

general language skills that assist students in the production of documents. She gives weight to spelling and grammar when judging students' abilities in TIM.

AK: Um, Ursula. She has done a lot. She has done a lot of work with her, um_ yeah you know, because I have said to her something about, um, she was looking through the book, that's right, at --, and she said, "I've done that", and so obviously, where she's come from, she said she did a, um_ ah, I'm not sure if it's a seventh form course or some course outside of school, and she'd got quite a few skills. And she's very, very good at it too, but what lets her down is her language. She doesn't identify with the language errors [spelling and grammar]. But she is quite good with using the applications, you know, doing things with draw, doing things with the paint and, um_ (ti 21/8/01)

For Mrs Keall, students' language skills are key indicators of ability in relation to the communication aspect of the SFC guidelines for TIM. Students are expected to be sufficiently familiar with English to be able to act on spelling and grammar check messages given by the computer and not to depend on this function.

AK: You are looking at communication quite a lot. Um, there is quite a weighting on it. Um, just down here [pointing to scheme] so when you, when you put it all together, and you have probably got, what, fifteen, twenty, yeah, twenty percent would be just on communication, being able to get their message across. And they, they just don't pick them up [spelling and grammar errors]. They just, um, and even when you ask them to compose a short sentence of eighty words, but they can't get the structure right. They don't seem to get the structure right at all.

R: Is that not picking up in that they are not reading it and don't have the language skills themselves and/or they don't use the spell check or the grammar check or_

AK: They do use the spell check_

R: if they do use it they have no idea what the problem is anyway.

AK: Well the thing is, of course the, some words just don't come up. They will look at the word and, you know, they don't think to go and look at a dictionary or anything like that and, and some of them do look the word up and they still don't know [incredulous]. What's the_ [page turning] a classic would be, um_ [looking through papers], this is one that was in the test_ That was the word that I put in and it had to be changed to that word. The weather was fine on such and such a day, well, I only think two people out of the whole class actually picked that up [misspelling of weather]. And that's not a, um, that's the sort of error that, um, if they read it I'm sure they should pick it up.

...and anyway, to and too, and all those types of errors that the spell check doesn't, doesn't pick them up. And when they do get underlined with the grammar they just look at that and think_ "Oh, that'll be fine", you know, and they go on. So language is not a strong point, at all. (ti 21/8/01)

This expectation is evident in instructions given to students.

AK: [to the whole class] OK, it's just a straight copy [the speed test]. When you finish it, make sure you spell check it and proofread it. You've got seven minutes, OK? So you don't have to start repeating it or anything like that. OK. Ready, set, go. (tc 27/6/01)

It is also apparent in feedback to students on assessments.

AK: [to Megan] Right now, I need to see you about this one here... You did that in April. OK. So you need to_ look at your spell checking and looking at this here. (tc 28/6/01)

Through all these signals it emerges that the teacher of 12TIM, Mrs Keall, advocates for the skills of the good secretary, that is, the person who is familiar with the keyboard, can key in information accurately, has the knowledge and initiative to correct text and is particular about textual accuracy. In this she is acting to mould people to fit into particular computer environments and roles, which are focused on document production and office support.

This doesn't mean that Mrs Keall opposes changes to TIM that would expand the range of applications to which students are exposed. In fact she thinks this needs to happen because students are becoming increasingly computer savvy and familiar with a range of applications in the younger years.

AK: Um, you've got to remember these kids [in 12TIM] have gone through the typing, and all of a sudden all of this [internet use] is just a big change for them. Whereas probably the ones coming through now, we do a little bit with the Internet with them in year 9. (ti 21/8/01)

However, Mrs Keall's background and values give prominence to applications that are useful in clerical and secretarial work.

In contrast, the feeling I gained from talking with the teacher of 10TIM, Mrs Nugent, is that she is less keen on the keyboarding/typing emphasis in TIM courses. She advocates for the expansion of the 10TIM course content to include a wider range of applications.

CN: We start off [in year 10] very broadly on word processing. We go on to_ within word processing we introduce things like a little bit of draw, using simple packages, and then just go on to spread sheets and_ We probably don't hit desktop publishing in year 10. It would be more something like_ Hopefully this year we are going to use PowerPoint. It will be some sort of presentation package we use. And really, that would cover the whole year asiding [sic] assignments and that sort of thing in between times. Yeah, yeah. Yeah, a lot of emphasis is on the word processing and spreadsheets still, which is, from my own perspective, a bit of a shame_ (ti 1/3/01)

Similarly

CN: Um. The [year 10] course as it stands at the moment, I suppose you could say is really text based with other features that we've now got available coming in, like the draw tool, and of course they've got clip art and all that sort of thing. Um, the word processing part really goes on into, I'd say part way through term 2, this is my year 10, and then we'll be going on and we'll be using things like_ um, whether they are going to use PowerPoint or some other type of, um, slide show package I'm not sure, but we'll be doing one sort of slide show. We'll be using spreadsheets, and that's quite a large portion too. That would be the other main topic that we'll cover as well, and all

the things that go along with spreadsheets. You know, like graphing and that sort of thing. Collecting data and surveys, and all that sort of thing. Yeah. So, basically, word processing plus features now, which makes it a bit more interesting for them. (ti 14/3/01)

However, Mrs Nugent is a newer staff member and she defers to Mrs Keall on matters relating to course design and content. She indicated to me that questions relating to such matters should be directed to Mrs Keall, who has administrative responsibility for TIM. It is Mrs Keall, then, who has the greatest influence over the design of TIM courses at KHS. Her values hold greatest sway and are reflected in the office practice construction of the years 10 and 12 case study classes. Would Mrs Nugent design the courses differently? My feeling is that she would, but that she is not in a position to do so. While she might be able to make suggestions, hers is not the authority within the business studies department to make changes of the nature and extent she might desire.

Text and information management at KHS is constructed as an extension of and development on earlier typing courses. The difference between the older typing and newer TIM courses derives from the incorporation of software applications relating to information gathering and data processing, such as Internet browsers and spreadsheets. Although TIM courses represent an expansion in the range of information practices to which students are exposed they retain strong connections with their typing roots. This is witnessed in the emphasis given to the production of text/documents and keyboarding practice.

TIM as creative practice

In describing the 12TIM course Mrs Keall is at pains to disassociate TIM from typing, to portray TIM as more than keyboarding. Her explanations reflect developments in the formal TIM prescription and assessment requirements, which have seen an emphasis on the use of software in context. This involves such things as communicating in an appropriate manner for the intended audience, applying decision-making principles to solve problems and using design features appropriate for a scenario or brief (New Zealand Qualifications Authority [NZQA], 2001). There is an emphasis on information skills in new assessment requirements. In the following excerpt Mrs Keall's description of the research process follows what Todd (2000) would describe as a sequential staged model of information literacy.

AK: What we are going to do today_ is_ have a look at this sheet here that I got yesterday [at NCEA training]. The reason I'm giving it to you is it will give you some sort of guide as to how to go about the research assignment that you are working on... Now the most important thing with the research, ah, that you are doing is your planning. OK, your planning is very, very important... We have got a plan of action, a flow chart, a list is produced which shows intended steps and associated notes... You should be keeping, ah, like a diary, like a log of what you are actually doing All right? So it gives me some idea of the process... It's the process that's really important... if you earn a credit, they are the things you have to actually show. OK. You have to have a list (or) --- outline, which leads to the production of (a) final solution. Some resource ideas... and consideration of (work) production and material costs... Now they had to produce, ah, three different ideas and, um, and shape them out. They actually had to draw them out, investigate which (were best), which would be the best graphics to put in what, you know, what size... OK, then they had to select what they were going to use... Now I'm not asking you to evaluate yours. All right? All I'm asking you to do is to, ah, access the information, select what you want and process it to your own (words)... And you have to produce, ah, what is it? A two page newsletter, or whatever you were doing – a brochure – on a subject of your choice... So what you're looking at is planning, investigating, selection, and design and production... And how terrible its going to be if you've produced this beautiful document_ at the end you've done everything – you've investigated, you've selected, you've designed and you've evaluated it – but you didn't do your planning and you didn't show them your planning sheets, you're going to get a no credit... (v 12/6/01)

This construction of TIM involves students in making decisions about the form of documents or information presentation and allows them greater flexibility than in earlier typing courses, despite the requirements for students to follow a fairly rigidly defined process. In this sense it is constructed as more creative practice than typing.

Mrs Keall is enthusiastic about the new construction of the 12TIM course. She explains that she has structured 12TIM in a way that emphasises problem-solving and design components. The course and assessment outline for 12TIM at KHS, which she developed, has problem-solving components relating to design and software use at an assessment weighting of 55%. Mrs Keall sees this as a key development and distinguishing feature of the 12TIM course.

AK: So rather than in the past, when we have had School Cert typing or Sixth Form Certificate typing they have had to key everything in and they have to have regimented formats for letters and regimented formats for this and that and everything else, um, now it [is] totally design. It's what appeals to the eye. So that's, that's the main focus. It's a real difference. (ti 21/8/01)

The tone of the conversation signals that Mrs Keall thinks that the introduction of a design component in 12TIM, the eye appeal, is a very positive thing. She appears to be excited about the curriculum changes that distance TIM from the typing tradition. The implication is that the curriculum developments give greater intellectual credibility and applicability to TIM in the information age. Linking problem-solving with design, and positing this as thoughtful and creative practice, provides an academic basis for TIM. Also, the new construction is seen to be

more interesting and enjoyable. Thus TIM is perceived to be more than routine keyboarding/typing. It is thought to encourage originality and creativity in the production of documents and the presentation of information.

Creating gendered subject cultures

It is in the construction of CPS as IT/information systems and of TIM as office practice that gender plays the most obvious part in the creation of subject cultures at KHS. These constructions contribute to the establishment of gendered subject identities – CPS as a subject of particular relevance for boys and TIM as a subject primarily for girls. The courses are not constructed as exclusive domains for either gender. However, in their association with particular computing practices and with what are perceived as different interests for males and females, they take on gendered identities.

CPS – masculine identity

At first glance gender appears to have little to do with the way CPS is constructed at KHS. However, teachers attribute CPS with a masculine identity. They associate the subject with what they perceive to be the computer preferences and interests of males, and therefore organise the course in a manner that helps to create IT people, as opposed to office workers.

It could be argued that the construction of 12CPS as a basic skills course for computer users acts against the reproduction of gender stereotypes. The inclusion of a range of software applications, including programming and word processing, identifies 12CPS with a range of computer functions performed by males and females. The content mix of 12CPS thus resists the identification of the course with the computer interests of one gender. Historic moves to distance 12CPS from mathematical computing and to create a general course for users softens gender stereotypes of computing as a masculine domain.

Nevertheless, 12CPS retains an association with computing practices that are seen by teachers to particularly suit the needs and interests of males. This is not to say that 12CPS is viewed by teachers as an exclusive male domain or constructed as a course solely for boys, but that they

view the distinguishing aspects of the course as being of particular relevance for male students. Programming, in particular, comprises a gendering feature. It is thought by teachers that boys in 12CPS favour programming and that girls are more reluctant programmers.

GL: Um, especially when you get to programming, boys perhaps respond better to the programming section than the girls, but the girls often, are often surprised there that they actually enjoy the challenge. (ti 11/5/01)

And

AK: ... The boys seem to follow the computer studies a little bit more. They seem to want to get into the programming, whereas the girls don't do the programming quite so much. They are not quite so interested in that. (ti 21/8/01)

Mr Lucas foresees 12CPS moving away from practices associated with office work and towards content relating to computer control. This means placing greater emphasis on operations such as programming and web authoring. In doing so it is moving away from a construction of CPS that he thinks is favoured by a particular group of females.

GL: We are moving away from the, if you will pardon the expression, the girl who is going to go into an office and just do a bit of typing, which is a group that we have had before, especially at year 12, but we are finding at year 13 we are getting more the ones that want to go in a bit more technical way, um, because that's the way they see their interests going. (ti 19/11/01)

And

R: So, Is it a fair or accurate [comment] to say that computer studies will become potentially more *technical*.

GL: It could, yeah. It may. Um, yeah, I suppose it is in a way. We are really looking, um, at those people that want to go on to polytech or university and want a background in computing, because that's where we're finding a lot of students, especially the boys, are heading... And so, to make full use of the new techniques of the Internet, programming, um, especially, um, we are going to move that way.

R: So, is that, that group, particularly the girls who were looking at an office practice career or something, are they going to be therefore looking at TIM do you think, as their option?

GL: Probably, yes.

R: Is TIM going to stay in that office practice mode?

GL: Well, yeah, but TIM goes and becomes technology and it becomes that information side of it [technology curriculum]. (ti 19/11/01)

There is a clear association of office work and typing with female practice in Mr Lucas's thinking. He is somewhat disparaging in his view of this practice, which is evident in his reference to girls wanting to do "a bit" of typing. Word processing is trivialised in the reference to it as "typing", which also carries undertones that it is somehow dated or

technologically unsophisticated. The suggestion is that the anticipated 12CPS course will better meet the needs of students, especially males. The observation that students want to pursue computing in “a bit more technical way” implies a wish to pursue applications associated with information systems and software engineering. This would position 12CPS as a more specialised computer course, moving it towards a computer science construction and a domain of practice that has traditionally been dominated by males.

The process of course specialisation appears to contribute to the gendering of the CPS as a subject. In the drive to establish key points of difference for 12CPS, to provide a unique identity that distinguishes it from the competing 12TIM course, gender stereotypes pertaining to computer use are reproduced. The historical inclusion of programming in the course, albeit only one of six units presented in a year, provides a key point of distinction between 12CPS and 12TIM and has effectively aligned CPS with perceived male computer interests and distanced it from perceived female computer practices. Planned moves to reduce the emphasis on word processing and change the structure of 12CPS to include more programming and content related to computer systems and networks appear likely to reinforce the gender stereotype of computer studies as a course for students, male or female, who have an interest in what have traditionally been male dominated computer practices. The construction of a masculine CPS identity is intertwined with actions and intent to create IT people; that is, to position students for possible vocations in the IT industry. This doesn't mean training students for IT jobs, but providing background and experience that would enable them to pursue further IT study at tertiary level or in the work place

The gendered identity of the 12CPS course is complex and subtle but it can be seen to lean towards a masculine construction, at least in the short term. This is not to say that 12CPS is positioned as a course exclusively for boys – rather that it is for students who teachers construe as having interests and/or desire to pursue a vocation in the IT industry, a field that has been traditionally dominated by men. Nor is it to say that such a gendered subjectivity is immutable. What constitutes male or female computer practice is changeable. However, at the time of this research, 12CPS is imbued with a gendered (masculine) identity.

TIM – feminine identity

The ways in which the teachers talk about and present TIM reveals a tension between older keyboarding and newer information management constructions of the subject. This contributes to and reflects an evolving gendered identity and culture for TIM.

Mrs Nugent describes a historical and persisting association between TIM and typing, which maintains an association between TIM and feminine computing activity. However, she intimates that changes in the TIM curriculum in practice have had the effect of softening the association of TIM with female practice, thereby making it more attractive to males.

CN: Um, last year I had one [junior] class which was probably 50/50 [gender balance] and it does seem to be changing. There are more males coming into doing TIMs because I think now TIMs is perceived more as a computing course than a typing course and I, I think that attracts, ah, more male students into doing, you know, into doing TIMs. Yeah. (ti 14/3/01)

Whether or not boys really think of TIM as a computing course is moot and will be investigated in Chapter 6. The above excerpt shows that Mrs Nugent associates different computer related activities with masculine and feminine practices. Different courses, including TIM, are seen as more or less attractive to males or females depending on whether they are constructed as computing (masculine) or typing (feminine) subjects. Text and information management is thus ascribed a feminine identity, albeit a perceived changing identity as TIM moves away from its typing origins and the associations with feminine computer practices are softened.

Mrs Keall maintains associations between TIM and female office work in her discourse with students. She tends to use female characters and office contexts in explanations and examples that relate to the applicability of TIM in the world of work.

AK: If I want to enter a new record, I can go like that. And that's what you see on a screen. So say you're going in to get some insurance_

Lu (Lucy)?: Yep.

AK: OK, the lady would say – well she's not going to ask you whether you're male or female. She should know. OK, she's going to type in M and she's going to say are you Miss, Mrs or whatever. All right? And she's going to key it in just like that. So you're going to think to yourself, is that form going to be user friendly. (tc 7/6/01)

In this excerpt it is a fictional female character that is inputting information into a database. Whether the use of the example of a female office worker is unconscious stereotyping or a conscious response to having an all-female class, the effect of using the female pronoun is to reinforce the idea that TIM is preparation for traditional female computer work in an office environment or related practice. Although she acknowledges the broad range of possible work and career paths of students in 12TIM, Mrs Keall maintains a traditional image of TIM as preparation for office work that is dominated by females. This is a conservative view of TIM and contributes to the creation of a feminine subject identity.

Teachers explain the lack of male interest in 12TIM as male resistance to the association of TIM with typing and document production and concomitant attraction to particular aspects of IT that are addressed in CPS but not in TIM. Mr Lucas, for example:

GL: Yes, yeah. Well, of course once they changed typing to TIM then the structure got a bit blurred_ ah, in terms of perception of what the course was. But when it was typing boys said "Oh no, I'm not doing typing!" But they would do computer studies. (ti 19/11/01)

Mrs Keall suggests that it is the focus on presentation, factors relating to neatness and precision in document production, that tends to appeal more to girls than to boys. For example:

R: Do you have any sense of what draws this particular cluster of students say to TIM as opposed to computer studies?

AK: ...They [the girls] are more at, um, looking at doing, producing something, um, making it look nice, that type of thing. But, yeah, we have that sort of cross overlap in there. But in saying that they [CPS] are under unit standards, all of those, and we have stayed, um, clear of that really. So um, yeah, so_ yeah, not many of them went to computer studies, really. Only, mainly, a lot of the boys did. Mainly for the programming, I think. There is no, not the emphasis on the word processing at all. (ti 21/8/01)

Mr Lucas is similarly of the opinion that boys have less patience and are less careful with the presentation requirements that are valued in the production of documents.

GL: ...The girls tend to be a wee bit better on the presentation but not necessarily so.

R: Are there any particular units that the group responds to best, or_ seem to spark more in?

GL: Well, boys tend to be, probably the spreadsheets. But again_ they often lose their enthusiasm when you say "No, it's got to be presented right". It's still_ Boys still have this thing about presentation_ You know, "It works! Why should I have to do it_ that way?" I say "Well, if you don't present all the information someone reading the thing then can't figure out what you have done." And I say "You'll need to do it like that." "Oo, it works!" [imitation of verbal grunt] (ti 11/5/01)

Likewise Mrs Nugent attributes boys' lack of interest in 10TIM to the emphasis on text production and to boys' impatience with this. In her opinion, girls are more inclined to tolerate the routine of typing.

R (Researcher): OK, so what aspects of this course, because you would have taught this course a few times, do you think students actually respond to really well.

CN: Ah. OK_ When they are creating something. Where they actually can see_ They're aiming toward something and they are creating something or solving a problem of some sort. Not just sitting copying text. They, they get, very soon get bored with that which I feel is very understandable. Yeah, they need to be actually creating, or doing, or designing, or something they can see an end result for. I think is important for them too. Yeah.

R: So is it fair to say that the converse then, is that if they are just doing text, that that is the stuff that they respond least_

CN: Least respond to. That would be the other end of the scale. Yeah. Although some students will just blindly do exactly what you say. And they will just sit and do entering text all the time without any, you know, any adverse reaction to doing that.

R: What type of students?

CN: Um. Mainly the girls. They would just do it and not question if they had to just sit and type out text all the time.

R: Why, why do you think that is?

CN: I don't know. I don't know whether its, um, a wanting to please, or whether it's just maybe not to question authority. I don't know. I don't know why that would be. But generally boys will say "Oh, for goodness_ This is boring! Let's do something else, Miss!" you know, if that happened. Yeah. (ti 14/3/01)

Thus the teachers perceive and assume gender differences in students' interests and responses to different IT courses and feel that TIM appeals primarily to females. They assume a gendered identity for TIM courses based in their experiences working with male and female students.

Mrs Nugent appears to favour developments in TIM that move it closer to a computer studies/applied computing construction and away from traditional text production/typing practices. She expresses an interest in incorporating a broader range of computer applications and greater emphasis on design components in the 10TIM course. In this she challenges the traditionally gendered construction of TIM as office practice, with an emphasis on keyboarding. She is wary of criticisms and prejudices against TIM, while presenting a personal view of TIM as an inferior or less valuable option than alternative IT courses. The tone of the above excerpt gives the impression that Mrs Nugent sympathises with the boys and their impatience with the typing component of TIM. Her description of girls who "blindly" do

what they are told and are happy to sit and type out text is disparaging. By implication, Mrs Nugent empathises with the mainly male students who question and resist the “boring” routine of typing. She is critical of the amenable students, mainly female, who show interest in learning to be skilled typists or keyboard users. She appears to feel that the current construction of TIM is limiting for students, confining them within a female typing tradition, which is something that she would like to see change.

It could be argued that teacher interest and emphasis on the design and problem-solving aspects of TIM is something that would challenge the gender stereotype of TIM as female computer practice. However, creative practice in 10TIM and 12TIM at KHS is tied to document production – the goal is to create aesthetically appealing documents. Thus the creative practice component of TIM can be viewed as an extension to or development on the office practice model. I suggest, therefore, that rather than break down gendered divisions the construction of TIM courses as creative practice contributes to the maintenance of its gendered character.

For the teachers of specialist IT classes at KHS, TIM is gendered by association with computer practices that have traditionally been dominated by women, such as typing and clerical functions. This is in contrast to 12CPS, which is viewed as a course more applicable to the needs or interests of males. Although the scope of TIM courses at different levels at KHS has broadened, the emphasis on document production and keyboarding remains a point of distinction between TIM and CPS in the minds of teachers. Teachers’ observations of students’ attitudes and behaviours reinforce gender stereotypes and lead teachers to think of keyboarding and document production as a ‘girl thing’. The teachers who are the focus of this study share the view that it is the office practice construction of 12TIM that leads males, and some females, to reject 12TIM when making subject decisions, especially when they have a choice between competing IT courses at senior level. They associate TIM with work that appeals to females – or perhaps more accurately to some females – and does not, in general, appeal to males. The association of TIM with office practice gives the subject a gendered (feminine) identity in the minds of the teachers that administer and present IT courses at KHS.

Summary

CPS and TIM courses at KHS are similar in their technocratic construction. Teachers present and think of them as introductory courses to computers and commonly used applications.

Units of work and lessons are similarly structured, in ways that require students to engage in sequences of activities that teach them about the functions and menus of various applications, and to practice using the different functions.

Despite the similarities in content and structure, the teachers of CPS and TIM courses attribute the subjects with unique and gendered characters that relate to differences in subject content and emphasis on different IT practices. This is evident in the discourses relating to CPS as IT/information systems and TIM as office practice. The subjects are associated with computer practices that are historically dominated and preferred by different genders. For example, girls are thought to care more about presentation and consequently to be more interested in TIM. By implication, TIM is thought to be better suited for girls. In contrast, boys are thought to reject TIM in part because of the emphasis on typing and presentation factors and to favour CPS for its mathematical and programming components. Neither the CPS or the TIM courses are promoted by teachers as courses for one or other gender, but aspects of the courses are thought by them to appeal more to males or females. Teachers may challenge assumptions of gender difference – for example, Mr Lucas states that girls are often surprised at how well they do at computer programming and suggests that they are just as capable as boys at this aspect of computing – but they also feel that the courses they present have different appeal and relevance for male and female students. CPS is attributed a gendered (masculine) identity and TIM is imbued with a gendered (feminine) identity relating to subject content and the perceived reception of this content by students.

Teachers are influential in constructing gendered subject identities and a gendered curriculum culture in the way that they organise and present different specialist IT subjects. It is not the gender of teachers as much as the traditions or subject culture in which they operate that appears to have a greater influence on teachers' thinking. Mr Lucas has a long history of involvement with computer studies and favours this construction of IT practice. In contrast,

Mrs Keall hails from a career in a variety of office environments and is enthusiastic about TIM and the courses she has developed. Mrs Nugent reveals a tension between her professional background in applied computing, which predisposes her to favour computer studies as more intellectually demanding, more interesting and of higher status than TIM, and her current employment as a TIM teacher, which commands her loyalty and appears to make her reluctant to criticise the construction of TIM courses at KHS. The gender of the teachers does not determine that they will favour particular constructions of IT, with males preferring CPS and females favouring TIM. Mrs Nugent provides a counter to any notion that female teachers necessarily favour TIM. Her work and education background in applied computing means that her views on the relative merits of CPS and TIM are more aligned with those of Mr Lucas than those of Mrs Keall. The way that teachers, especially those with administrative responsibility, construct the CPS and TIM subjects in practice at KHS can be seen to reflect the gendered computing and curriculum traditions of their personal life experience. They can also be seen to maintain these gendered traditions in practice.

It is in the competition between subjects, the specialisation of competing computer courses and the differences that this creates, that CPS and TIM most obviously acquire gendered subject identities. The teachers with influence and responsibility for different IT curriculum areas at KHS want to sustain CPS and TIM as separate curriculum domains. They are acting politically to protect their departments and subjects. They can also be seen to be acting conservatively to maintain the *status quo* of a gendered IT curriculum, albeit unconsciously. The teachers are not advocating for different IT courses for males and females and do not see CPS or TIM as exclusive domains of either gender. However, they accept that males and females will prefer different courses and cater to these preferences. For example, proposed changes to the 12CPS course that will move it towards an information science model of IT are justified in part by Mr Lucas for the relevance of programming and information systems for a particular group of (male) students. The teachers recognise and accept the gender differences in students' responses and preferences for different courses without apparently questioning their potential role in sustaining these differences *via* an inherently gendered curriculum. They actively, although perhaps unwittingly, support the preservation of gendered subject cultures and identities in the maintenance of a traditional curriculum structure at KHS.

The creation of a gendered curriculum culture could be construed as an equity problem (see Chapter 2). However, the conservative construction of the curriculum at KHS and the maintenance of gendered subject cultures could conversely be seen as responsible action on the part of the teachers. It could be argued that the teachers at KHS recognise and reflect a social reality. They are engaged in creating people who will fit into existing (gendered) vocational structures. The broad scope of CPS and TIM courses, combined with the specific and different vocational character attributed to each, sets students up for promising lines of work, particularly the less academically inclined students. The tenor of conversations with teachers, particularly with Mrs Keall and Mr Lucas, suggests that they see themselves as acting in the best interests of their students in the ways that they organise the CPS and TIM courses at KHS.

Teachers work within curriculum traditions and subject cultures, not separate from them. In their adherence to a traditional IT curriculum structure at KHS, the teachers of CPS and TIM are maintaining a gendered IT curriculum culture, albeit a subtly gendered culture. The particular historical and political departmental arrangements at KHS have contributed to this situation. Other schools may or may not reproduce the gendered nature of the curriculum in similar ways, depending on their own unique historical curriculum arrangements and the personal agency of individual teachers.

The ways that specialist IT subjects are constructed in practice at KHS, as described in this chapter, and the gendered participation patterns for different IT subjects that are described in Chapter 4 suggest the existence of deeply embedded and gendered subject cultures.

Consequently, there is a gendered IT curriculum culture at KHS. It could be argued that a gendered curriculum culture is inescapably a part of students' experiences of specialist IT courses at KHS. However, the idea that students' experiences of computer subjects are a matter of gender is gleaned from indirect evidence up to this point. To get more direct evidence the focus of investigation will now turn to students and their experiences of different specialist IT courses. The phenomenon of classroom experience is investigated in Chapter 6, with a view to describing the particular experiences of individuals in specific classroom contexts.

Chapter 6 **Case studies: students' experiences of IT courses**

What are students' experiences of specialist IT subjects (CPS and TIM) in the case study classes?

Not all students will experience specialist IT courses the same way. Every individual's experience is unique, and in that sense different by definition. The question, then, isn't whether students' experiences differ, but whether there are discernable similarities in the differences. What factors help to define students' experiences of IT courses? Do different groups respond in similar ways? Are there differences in experiences that can be defined by gender?

Selected embedded student cases from the CPS and TIM case study classes are described in the early part of this chapter in order to illuminate a range of influences on students' experiences. By focusing on these individuals one gets a feeling for the complexity of students' experiences. Threads are drawn together in the latter portion of the chapter to highlight the factors that define the differences in students' experiences. The intersection of experience and gender is discussed in Chapter 7.

Students experiences of IT

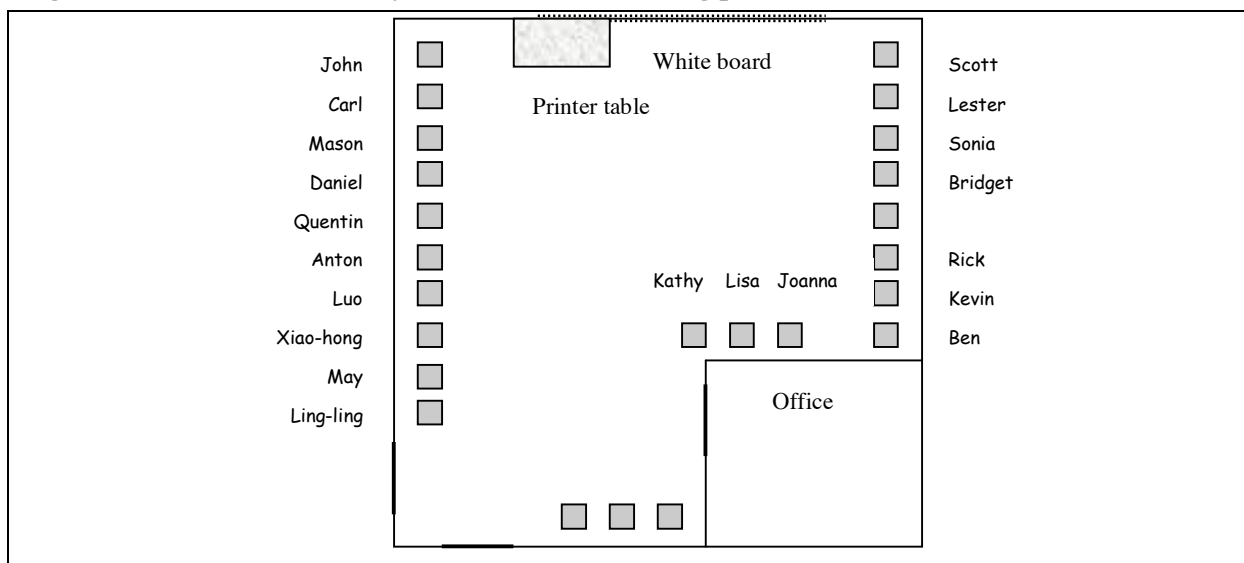
Experience of specialist IT courses can be defined by the interaction and activity in which participants engage around computers and the meaning they make of their engagement with technology, which is reflected in attitudinal factors relating to such things as likes, dislikes, self-confidence and ideas about the worth of courses. These factors are intertwined in the experiences of students. Given the importance of context in meaning making, students' prior experience and interactions with computers outside the classroom are considered in the discussion pertaining to their classroom experiences.

The nine student cases described in the early part of this chapter comprise a selection of males and females from 12CPS, 12TIM and 10TIM classes at KHS. They are chosen for their gender mix. Also, they include examples from different parts of an attitudinal spectrum, individuals who construe their experiences in positive and relatively negative terms, and their experiences illuminate the range of themes that are discussed subsequently. In the interests of brevity and lucidity it is not practical to detail all the embedded student cases from the three classes. However, all 22 student cases inform the discussion of factors that define students' experiences of specialist IT courses that is presented in the latter portion of this chapter.

Students in CPS

Four student cases are presented from 12CPS. Three of these – Joanna, Mason and Scott – can be construed as having positive experiences in 12CPS. Kathy's experience represents a contrasting and more negative view of 12CPS. Typical seating arrangements for the students in 12CPS are pictured in Figure 1.

Figure 1: 12CPS classroom layout and common seating positions



Joanna

Joanna is interested in the range of applications used in 12CPS – word processing, databases, spreadsheets, programming. She says that she likes word processing the best, because “it’s easy” (si 30/10/01), but she appreciates the range of applications for their utility.

J (Joanna): Oh, well they have all got different aspects which are all good. Like spreadsheets is calculating stuff and databases, you know, putting in information and stuff, so they are all pretty good when you figure out how to work them and all that. (si 30/10/01)

She finds the programming component of the course most challenging, but derives particular pleasure from successfully creating programs.

X (Xiao-hong): I think [I like] the programming (best). Because, ah, that’s very difficult but it’s very interesting. Yeah when I, when the something going up [graphic appearing] my work is ---

J: Yeah true. And then you can say I made a program. That’s really cool.

X: Yeah. Yeah.

R (Researcher): So to re-interrupt you, you think you get quite a strong sense of *achievement* when it happens [the program works]?

X: Yeah.

J: Yeah. (si 30/10/01)

And

R: ...are there any particular things that have happened in the class or that led you to think that yes you are good or you are not so good_ with computers?

J: When I wrote that program and it worked. It was like “yeah, I did it!” So that was good.

R: What program was that?

J: One of them. It was one where you had to pretty much do it all yourself and it wasn’t any copying from pages and adding. It was everything and it took me a while and then I got it to work and I was pretty stoked.

R: What did, what did it have to do? What was the program to achieve?

J: We had to do like a greeting and then had to have like input_ stuff like_ data and then it had to do calculations and put it out and stuff. (si 30/10/01)

Success with programming activities in class is met with responses such as “Cool! I did it” and “Sweet!” There is excitement in new discoveries – “Hey look – colours” (sc 28/8/01). A compliment from Ben on the construction of the robot face is acknowledged and pleasure.

Bn (Ben): [to himself] (RAM) on next loop_ [to Joanna] That looks so cool.

J: Cool? I can say I invented it. (sc 28/8/01)

She rates herself as a competent computer user, above half way on a scale of one to ten, as someone who knows all the basics and a bit more, but who can't do "really technical stuff" and doesn't know much about the "insides" of a computer (si 30/10/01). Part of the reason for Joanna's positive self-assessment is her perceived superior ability with programming in 12CPS, which she thinks proves her to be a more competent user than many others in the class. Also, she is confirmed in her ability by her good test results. She ranks among the top students in the class.

Joanna appears to enjoy the emphasis on independent work in 12CPS and to take pride in being able to work things out without assistance. For example, in the following excerpt Joanna seeks help from Tim, but resists suggestions that she is in some way deficient for requiring help.

J: [to Ben] I need your heelp [to draw circles]. [wheedling tone]

...

J: That's OK. So I do the middle point, eh Tim?

Bn: Notice that, you notice who she's [Joanna's] asking for help. [teasing]

J: Yes. Coz I don't know this. It's not written down. [defensive tone] (28/8/01)

The implication is that Joanna would be able to work out the procedure for herself if there were a written guide. Joanna is not averse to asking for help from her peers or the teacher. This is a common problem-solving strategy and a characteristic of the parallel learning in which 12CPS participants engage. However, she appears not to appreciate the public advertising of her need for assistance and acts to maintain a reputation as someone who is computer competent.

Another positive experience in 12CPS claimed by Joanna relates to an incident when she achieved a better result than Ben, which she says is "always good" (si 30/10/01). Although Joanna denies that there is a lot of competition between her and Ben, indicating that any rivalry is "just stupid", meaning of no consequence, the impression is given that she is competitive. Joanna considers Ben to be skilled with computers and turns to him when she wants help. She is aware of her ability relative to Ben's and beating him provides a sense of achievement.

Joanna is comfortable with the competitive, individualist classroom culture in 12CPS. In interactions with Kathy and Lisa, Joanna demonstrates that she has faith in the efficacy and sufficiency of the task sheets and that understanding is just a matter of following the written instructions. For example:

L (Lisa): I've already done this but I don't think I printed it out so I've done it again.

GL (Mr Lucas): Yeah, but you add those two lines at the bottom.

L: Why?

GL: Because that's what it says.

J: [heard in background] That's the question. (tc and sc 28/8/01)

Similarly

L: Hey, that's red! Wow!

K (Kathy): Have you got a ---? Mine didn't work_ How the hell did you do that?

J: Follow the instructions. (sc 28/8/01)

Joanna's message to Kathy is that she shouldn't bother Joanna with queries. Joanna is impatient with Kathy's frustration. Her retorts reveal that as far as she is concerned success in 12CPS is a matter of working systematically and independently through task sheet instructions, as she does.

Joanna appears to want to do well in 12CPS, and to be seen to be doing well and to have the right attitude. This means showing herself to be interested and motivated, which is proven by doing things like completing activities out of class time and participating in class discussion. She is observed in a range of lessons to contribute information and to ask questions in whole-class discussions in order to clarify computing procedures and activity requirements. Whilst she doesn't always get the answers correct, Joanna is affirmed for her contributions.

Sitting as she does in a fairly talkative group, Joanna engages with Ben, Lisa and Kathy in a mixture of social chat and work related talk during lessons. However, she resists being distracted to an extent that will impinge on her ability to complete the requisite tasks. For example, in one lesson (ob 28/8/01) Joanna engages in more off-task activity than is observed to be usual in other lessons. Although she talks fairly constantly through the lesson, engaging primarily with Ben and Lisa in social discussions, and being physically distracted by activities

such as opening the window, applying lip balm and trying on Ben's headphones, Joanna engages with the computing tasks for the majority of the time. She completes an activity that requires her to write the code to create shapes and draw a robot face, which contributes towards an assessment, and moves on to a set of tasks that introduce students to the use of variables in program code. She follows the instructions to draw a cone, cut it in half, position an arrow through the centre of the cone, and take notes on the commands and effects achieved. Toward the end of the lesson she gets more heavily involved with the task, to the point that she good naturedly tells Ben and Lisa to "Stop talking!" and announces that "I need to think here!" (sc 28/8/01). Joanna purposefully disengages herself from the off-task exchanges to focus on the computing task at hand.

A computer is integral to Joanna's daily life and social interactions outside of 12CPS. She has her own computer, which she says she uses mainly for projects that entail word processing and Internet research and for e-mail communication with her mates. She comments that she "loves" her computer and that she uses it "too much" (si 30/10/01). Her enjoyment in using computers disposes her to want to know more about them and how they work, hence her participation in 12CPS. Also, she wants to pursue tertiary studies and a career in business, which provides a reason for taking a specialist IT course, specifically 12CPS. She sees herself as a CPS girl and rejects suggestions that she might have taken TIM. Joanna construes CPS as the more academic subject and herself as an academic student, hence her preference for CPS.

Whilst she doesn't intend to continue with CPS in year 13, Joanna indicates that she has found her experiences in 12CPS useful – "I think this class has really helped me out in_ learning more about computers" (si 30/10/01). Joanna's experience in 12CPS is one of enjoyment in the social interactions and engagement with computers, and challenge and satisfaction in mastering unfamiliar software and achieving good results for assessment activities. Joanna presents as a confident computer user and learner and she places a positive construction on her experiences in 12CPS.

Mason

Mason is a computer enthusiast. He wants to be a programmer and plans to go to polytechnic next year to pursue computing studies. Knowing this helps make sense of his decision to take 12CPS and his positive attitude towards the course.

During observed lessons Mason maintains a high level of interest and focus on the computing tasks. He is socially reserved and rarely interacts with students, other than with the boys with whom he shares a common computing interest. In the observation sessions early in the year Mason sits alone at the front of the room and works independently. In one such lesson (on 18/5/01) he shows little interest in what others are doing and doesn't seek assistance from any students. Likewise, no one initiates conversations with him or seeks his help. At the beginning of the lesson Mason enters the room and goes directly to his seat. He watches others fooling around with rubber bands but does not participate in their play. At the end of the lesson, as the students are packing up, he makes a teasing comment to Kevin. His joke elicits no response. Mason remains outside of peer discussion and social interactions during the lesson, both physically and socially distant from other students.

In later lessons Mason sits beside Carl and John, although he is observed to interact mainly with Carl. Mason appears to be drawn to these boys by their common fascination with computers; they have a shared hobby interest in building computers and computer games and a common interest in the programming component of 12CPS. Their conversations reveal these mutual interests. For example:

C (Carl): Just type in the (head) crap, and_ these monkeys come up_ ---

M (Mason): What!

C: That's QBasic. It's another --- and you make games.

M: Chipmunk Basic you just make pictures really.

C: Yeah. Sort of like_

M: You can do other things to it.

C: Sort of like that (Jade) one.

M: Hmm. (Jade) was make programs. It's a program to make programs.

C: Well, we made that picture.

M: Yeah, we made it, ah, draw in program. [short pause as students work]

C: What happens? [asking about current activity]

M: It does a line.

C: What does Graphics_ oh [Graphics 0]? [asking about a question on the task sheet]

M: Graphics 0? It makes_ zero difference_ Titles the (thingie)_ called Graphics. (sc 21/8/01)

Mason is excited about things he learns in the programming unit. His response in watching Mr Lucas demonstrate something for Daniel is “Hey cool. I didn’t know you could do that” (tc 21/8/01).

There is a feeling of friendly competition in the teasing banter between Carl and Mason, especially on Mason’s part. They are each aware of what the other is doing. They share their successes, comment on each other’s work and offer advice, sometimes solicited and sometimes unsolicited. They engage in parallel learning, each engaged in his work but monitoring what is happening to the other and drawing on the other’s knowledge. Conversations between Mr Lucas and Mason also suggest that Mason is motivated by competition.

GL: So why did you have four on it?

M: It was an accident.

GL: No it isn’t. You are rushing again. You are rushing, you are rushing ---.

M: Was not.

GL: You are. It is not a race to get to the end.

M: I know.

GL: Right... But I want you to get these simple things right... I just want that corrected because it doesn’t work. Sorry. And the same with this one. (tc 4/9/01)

When asked to identify positive and negative experiences in 12CPS Mason says:

M: Positive would really be that we are quite a wee way ahead than the other classes_ probably the best_ but nothing to do --- yeah. We are doing pretty well. The negative is the class has pretty much *disappeared* since the beginning of the year. People just_ disappearing, going away from school and_

R (Researcher): Why is that a negative?

M: Just because it is a good thing to sort of be doing. Help later in the future... (si 14/9/01)

For Mason, being ahead of other classes is a source of pride. Interestingly, his purported negative experience is an altruistic response. Mason is concerned that others, such as Kevin and Rick, may be disadvantaged by not continuing with what Mason considers to be valuable

computer learning. He envisions a future for himself and others that necessitates general computer knowledge. In this he subscribes to the imperative of the knowledge economy. He also supports the basic skills discourse for CPS.

Mason rates his ability with computers highly, as eight out of ten. He signals that he “can get most of the stuff we are doing pretty easily”, it “just takes a bit of practice” (si 14/9/01), although he says that he sometimes finds computers frustrating when they don’t do what he wants them to. Mason’s positive assessment of his ability is confirmed for him in interactions with his teacher, often in subtle ways. For example, in one teacher-student exchange Mason completes an activity and Mr Lucas shows pleased surprise. Mr Lucas has to go to the resource room to collect an additional set of instruction sheets for him, which isn’t at the front of the class amongst the bulk of activities that students are currently using. In another episode, when spreadsheet work is returned to Mason, he is told “But they’re, you’re OK. There’s no problems there” (tc 18/5/01). Also, there is a bond between Mason and Mr Lucas based on their shared interest in computer programming. Mr Lucas supports Mason’s hobby. For example, Mr Lucas explains how to obtain a copy of the Chipmunk Basic software to Mason, so that Mason can use it at home. The effect is to affirm Mason as having superior and special ability with computers.

Mason indicates that he is a regular computer user outside of school time.

R: Mason?_ Do you (use) it much out side of school time?

M: Heaps. Just spend most of my spare time building_

R: OK. What?_ Can you explain that a little bit more?

M: Well, my Dad_ we have had quite a few computers and upgraded them as we go and I’ve got all the old parts sitting in the shed outside. And whenever I get something new I switch it round and try to make it better. (si 14/9/01)

His voluntary leisure involvement with computers attests to a fascination with the technology, with the workings of computers. Mason conveys confidence to play around with the component parts of a computer, to manipulate the technology and to try to understand how it works. From his responses to a range of questions, Mason might be described as someone who experiments and tinkers with computers, both hardware and software. He likes computers and looks on them as a challenge – something to be manipulated, played with and ultimately mastered. He fits the stereotypical notion of a male techno computer geek.

Mason's experience of 12CPS is positive. He shows enjoyment in working with and learning about computers in class and with the way the course is organised and presented. He experiences success in 12CPS and is affirmed as one of the more expert students by the teacher and his peers. He also finds friendship and acceptance with a small group of boys who share similar computer hobby interests.

Scott

Scott is a self-confessed computer hacker. However, he doesn't intend to pursue a career in the IT industry, planning instead to do a farming course at polytechnic and work on dairy farms. He struggles to meet academic requirements and is labelled by himself, Mr Lucas and his peers as having learning difficulties. He is doing the unit standards assessment components of 12CPS, but not Sixth Form Certificate (SFC).

Mr Lucas treats Scott as a special case and acts as a mentor for him. At lunchtime Scott can often be found in the locked computer room, with the permission of Mr Lucas. During class and at other times he does not always work on the prescribed tasks for 12CPS. I observed him working on his own programs, creating games and simulating different effects, during class time (including ob 4/9/01). Mr Lucas allows Scott to engage in this activity. Also, Mr Lucas provides support for Scott in a variety of subtle ways, coaxing him into constructive activity in class. For example:

GL (Mr Lucas): [GL goes over to Scott and puts his hand briefly on Scott's shoulder] ...Come on, save one for me [GL moves on to Ben]. (tc 21/8/01)

In this small vignette, the touch on the shoulder signifies care. Mr Lucas knows about Scott and his history, from their dealings in relation to discipline matters outside of the CPS context. There is thus a familiar relationship between Scott and Mr Lucas.

When working on a game Scott is very persistent. During one lesson (ob 4/9/01) Scott creates a program for a car race. When he strikes difficulties he persists with trial and error to overcome them. For example, when he gets a message indicating a syntax error he repeats the process of listing the code in the line, making an adjustment and running the program upwards of seven times before looking around to see if Mr Lucas can provide assistance. Scott doesn't

understand the word “syntax” and he adjusts his strategies when I tell him what the word means. When he encounters another problem he looks around several times to see what Mr Lucas is doing but makes no further effort to gain Mr Lucas’s attention and goes back to trying to solve the problem himself. He mutters to himself, “God knows what I’m doing” (sc 4/9/01), tries different options, reverts to the help menu, and eventually manages to achieve a solution, which is to include a remark statement.

Scott takes pride in his ability to create programs and likes to display his skills. At the beginning of the focus lesson (ob 4/9/01) he runs a couple of programs he has written. One is a game based on Russian Roulette and the other is designed to create different patterns depending on what keys the user pushes. He seems to be satisfied by his efforts and keen to demonstrate his achievement to me.

S (Scott): (Do you want) an awesome game?

R: So tell me, how does it work.

S: --- like click_ click_ [demonstrating program by clicking on mouse; messages that appear on the screen are “Fuck you’re dead”, when the player is shot, and “Chicken shit” when the player quits the program]

R: Oh, nice sentiment, Scott. [ironic tone]

S: You know that Russian game when you put one bullet in a chamber and you spin it.

R: Russian Roulette.

S: Yeah. That’s what this is.

R: So, the click is on return. Is that right?

S: Yeah, so you can see, see where that, see I got through them all but then (clicked)_

R: So, what you’re doing is --- writes type 1. Is that (loading it)?

S: Yeah, yeah, see type 1, spin the chamber, pull the trigger.

R: Yeah. What’s the return?_ The language [responding to message that comes up on Scott’s screen].

S: Well I can’t put_ flowery stuff on. It’s a boy ---

So (Sonia): Yeah, but not all boys say fuck [chuckles]_ I didn’t mean to say that real loud. Oops. That wasn’t meant to come out of my mouth.

R: So does Russian Roulette give you your kicks (does it Scott)?

S: Hey, I got bored, eh, so I had to make something [giggles]. (sc 4/9/01)

This excerpt is interesting for what it reveals about Scott’s experience in computer studies – the boredom he says he experiences in following through with the task sheet activities – and his desire for excitement with computers, which comes from designing and playing games in

class. The language Scott uses in the response statements in his Russian Roulette program is purposefully raw, in keeping with the virtual violence of the game, and intended to impress and shock. In talking about his creation as a “boy” game, Scott reveals that he thinks of his gaming activity as masculine activity. In creating violent games he is asserting his masculinity.

As is typical with most students in 12CPS, Scott’s peer interactions during lessons are confined to conversations with those who sit nearby, but then only intermittently. Sonia and Bridget are observed to seek his help on occasions. Scott discusses computer games with males in the class who share a mutual interest, such as Mason, but he usually works alone. The way 12CPS is organised and presented is a non-issue to Scott. He gives the impression that he hasn’t really thought about it, certainly not as a problem or concern. Scott is comfortable and happy to work individually and independently on computing activities in 12CPS. He likes what he thinks is a relaxed atmosphere in the class and being given opportunities to indulge his hobby and play games in class.

Observations in lessons show that Scott enjoys a friendly clash of wills with Mr Lucas. He resists efforts by Mr Lucas to get him to perform tasks in a particular way. Scott doesn’t worry about the method, as long as the product looks as it should and achieves what he wants. He likes experimenting or tinkering with the computer, doing his own thing rather than conforming to the task requirements. For example:

GL: [to Scott] Have you gone on to this too?

S: It’s real easy.

GL: I know it is_ You did an illegal command.

S: I know. I’m just trying different things.

GL: No, you do what *I* want you to do first. I don’t *care*_ (tc 21/8/01)

Scott resists Mr Lucas’s attempts to get him to program in a more systematic and conventional manner; that is, in a way that can be understood by others who may have to read or adjust the code. According to Mr Lucas, Scott is a skilled but unconventional computer programmer. He calls Scott’s approach “spaghetti programming” because the code lacks structure. He rues the difficulties Scott’s unsystematic approach may present for him in finding a job. Also, he is concerned at the negative influence Scott may be having on Mason by encouraging an

unconventional, slap-dash approach to programming, for example in the omission of sub-routines from code (ob 28/8/01, 4/9/01, 11/9/01 and 18/9/01). Scott rebels against the norms, but finds pleasure in his unconventionality and the attention it gains him. His approach to programming contradicts the idea that boys pursue programming in a scientific and planned manner. There may well be logic to what Scott does, but it is an unconventional logic.

Scott experiences rare success in 12CPS, albeit a relative measure given his learning difficulties and limited achievement for formal qualifications. Programming is a particular aspect of CPS where he can prove himself to be better than others. He says he likes 12CPS because he finds all aspects of the course easy to understand. Also, he indicates that the visual nature of computing makes learning easier for him in CPS than is his experience in other subjects. Scott enjoys the friendly support of Mr Lucas and being given opportunities to follow his own computing interests. These factors combine to mean that Scott construes CPS as a fun and interesting course.

Kathy

Kathy has a negative opinion of 12CPS. She is positive about computers and enjoys using them, but negative about what she does in 12CPS. Kathy is disparaging about some components of the subject and the way that units are organised.

In several lessons Kathy is observed to be frustrated as she goes about the computing tasks. During one lesson (ob 8/5/01) she is working on the last of a series of exercises to set up a database for personnel records, creating calculated fields, conducting queries and producing reports, before she moves on to a task to create a database on a topic of her choice, for which she needs to produce a task sheet of instructions on how to use the database and a list of ten exercises for interrogating the data. She works constructively for the early portion of the lesson, approximately twenty minutes, and then seems to lose interest and spend a lot of time off-task. As she works to complete the personnel records, Kathy experiences frustration at her inability to make adjustments and to get rid of a calculated field. She verbalises these feelings in comments to herself – “What! (Hey?!)” and “What? Ouww!” (sc 8/5/01). On several occasions she seeks help from the teacher, which is not forthcoming as Mr Lucas is preoccupied with a computer that isn’t working properly. As she waits Kathy shows signals of

impatience and boredom – fiddling with her hair, looking around, drumming her fingers on the table. After she gains Mr Lucas’s attention and manages to complete the personnel records activity Kathy expresses relief.

K: Yay, I’m finished [talking to herself]_ [long pause as Kathy prepares work to hand in] Yay I’m finally finished [comment to teacher].

GL: Good. (sc 8/5/01)

Her comment that she has “finally” finished shows that Kathy has been frustrated when working on the activity and hints that she is conscious of working more slowly than others. She also receives messages from Mr Lucas that she is working too slowly.

GL: ...These_ the rest of them are still going to have the same time frame in terms of getting everything finished.

K: I haven’t even finished – I’m not even up to the end of_ [Kathy gets work out]

GL: Well you’d better hurry up and work on it_ (tc 8/5/01)

In urging Kathy to increase her pace of work and complete the core exercises, Mr Lucas confirms for Kathy that she is lagging behind and adds to her sense of inadequacy.

Despite being conscious of her relatively low level of activity completion, Kathy shows little inclination to work on the individual database exercise. She seems to be unmotivated and uninterested in this task. She opens a new file but does little else on the activity. This may be because she is unsure what she should do or because she doesn’t have any information she could use to construct the database. However, she isn’t particularly interested in going to the library to get any information, an option that is given her by Mr Lucas, and opts instead to write some ideas down. Kathy signals that she is willing to work on the task out of CPS class time – “Can I do some of it at home?” (tc 8/5/01) – but is uninspired to work during this lesson. She spends the second half of the lesson killing time. She sits and monitors what is happening in the room, talks with Rick and Lester, puts on her track pants under her skirt, stands and reads the notices by the door, plays a computer game, packs up early and rolls over on her chair to talk to Lester, then gets her hockey stick and ball and practices dribbling while seated at her computer.

Part of the reason for Kathy’s procrastination and work avoidance appears to be that she finds the research task daunting and is disheartened by what she perceives as her slow progress. She

quizzes Rick about the topic he has chosen and the research activity requirements, and expresses admiration and disbelief that he has fifty entries in his individual database – “What?... Man. You’re kidding!” (sc 8/5/01). As Kathy is leaving the room, John asks her if she had saved a file and she responds with the comment “Save what? I’m not even up to ---” (sc 8/5/01). Kathy’s actions and conversations suggest strong feelings of inadequacy.

Frustration is evident in Kathy’s behaviour in a number of lessons. This shows in her interactions with Mr Lucas. For example:

K: I’ve got a question. I can’t get the female_ things. I’ve tried all these different things and it won’t work. I’ve got a_ put a --- female --- age [GL using Kathy’s mouse to show her what to do]_ What did you do!? [incredulous tone]

GL: Go back in to, go back and define, go and have a look at my, how I defined my filter.

K: I did that!_ I’ve done all that.

GL: And did you have contains?

K: Yeah.

GL: s?

K: Yes.

GL: Did you put a space after the s? You may have. [tone very reasonable]

K: Oh. Far out. [quiet response shows frustration] (tc 21/8/01)

Mr Lucas tends to interpret Kathy’s slowness to complete tasks to a lack of effort, failure to pay attention or deliberate work avoidance. Kathy’s frustration and Mr Lucas’s displeasure combine to create some tense interactions. Tension is revealed in accusations and forced pleasantries. For example:

K: Mr Lucas this won’t let me print.

GL: Well you’re connected. Course it won’t let you print unless you go and create a report. [incredulous, annoyed tone]

K: Oh that sucks.

GL: No, that’s what, why do you want to print this out?

K: Because. That’s all I’ve done.

GL: Yeah.

K: And that’s all I can do.

GL: Right, well then I need a copy of it on my disk.

K: Ohhh.

GL: Under your name and what it is. It’ll be Monkeys_ Kathy. All right? (tc 18/5/01)

And

GL: ...Kathy? [GL twirls his finger around, signalling to Kathy to turn around and get on with her work]

K: Yes Mr Lucas [mocking/forced friendly tone]

GL: Let's get some work done. [coaxing]

K: OK. (tc 28/8/01)

And in a later programming lesson

GL: ... [GL goes over to Kathy, who has her hand up] Come on. You spend more time fiddling with your pony tail (than) anything.

K: Well I am waiting for you to come over. You are always talking to those people [international students] down there! [agitated tone]

GL: Yeah come on. Schhh, schh, schh, schhh. [calming]

K: Do I just have to re-put in those and then change it to_

GL: That's right. That's what I told you the other day.

K: No you didn't.

GL: Yes I did. I said, it says modify the program. So all you are going to do is change the lines in there that you have to change. Like_ you see, you have got_ you need to change obviously that. You need to change that, that and that.

K: Yeah.

GL: All right. and that's all.

K: Yeah.

GL: You don't need to type it all out again... (tc 18/9/01)

Frustration with and difficulty in completing activities contribute to Kathy's negative view of 12CPS.

Nevertheless, Kathy enjoys the social aspects of 12CPS and values interactions with her peers. She is observed to consult most often with Lisa and Joanna, with whom she sits, and to a lesser degree with Ben. However, she doesn't always receive satisfaction when she seeks assistance from her peers and resents what she interprets as a superior manner and unwillingness to help on Joanna's part.

L (Lisa): ...Joanna is not very good at explaining.

K: No she_ yeah she says like "oh", like I asked her to see one of her sheets and she said "oh, I didn't bring it today". And I was like I just saw it in your book. But she's not_ she's not_ I don't know, she doesn't want to help.

L: No, she wants to get top of class I heard her say to someone.

K: Coz she is a brain box and she doesn't want to help other people so_

L: She expects that she should be doing more than what she is.

...

K: I'd probably go and ask_ John, or Carl [for help].

R: Why them?

K: Because they actually help me. Ah, coz I, I ah, I started off asking Joanna but she didn't help because she just says "oh, just ask Mr Lucas" but_ or I sometimes I'll, I'll ask Lisa. Yeah. (si 16/10/01)

Social interaction and cooperation is important to Kathy as a means of enabling her to solve computer problems and complete the requisite tasks. She is uncomfortable with Joanna's competitive and individualistic approach to work in 12CPS.

Kathy has a low opinion of her ability in 12CPS. She feels that in 12CPS she has no idea how computers work, which she attributes to stupidity on her part. She refers to herself and others who don't understand the work as "dumb arse" (si 21/9/01). However, she sees herself as a competent user of the applications she has at home – word processing, Internet, e-mail, games.

K: Coz_ coz I don't, I don't know. It's just, I don't actually know that much stuff but I can use a computer quite well. I can use my computer at home. (si 21/9/01)

Thus she distinguishes between her ability in 12CPS and in other computer contexts. Kathy rates her ability with computers as "about five or six" out of ten (si 21/9/01).

Kathy questions the relevance of 12CPS, particularly the programming component of the course.

K: ...I don't know. These things, I don't know. The [programming] exercises and stuff that we do on these computers, they are just, don't seem_ useful.

L: --- much point.

K: Yeah, there is no point to them. Doing the same thing over and over and over and over. (si 21/9/01)

She favours applications that she considers to be useful and easy to use – word processing and, to a lesser extent, databases and spreadsheets – and which are familiar to her. In regard to pedagogy, Kathy dislikes what she thinks is boring repetition in 12CPS. This idea contradicts other claims made by Kathy that she needs to repeat things in order to learn how to use an application. Given her perceived need for repetition and reinforcement it might be thought that

Kathy would appreciate the incremental structure of the worksheets. However, her apparently paradoxical ideas are explained when she talks about the amount of teacher assistance she feels she needs and receives. She complains that some units are “real hard and we don’t get enough help_ He is always helping other people” (si 21/9/01). Similarly, when asked to identify something positive that has happened in the class and something negative:

K: Oh negative. I’ve got lots of negatives. Um just not understanding the work and then not getting help with it. Just saying, “oh you should know that” or just not getting enough help with it.

L: When you are having to wait half an hour so you can get help. (si 21/9/01)

Kathy feels disadvantaged. She resents the way she always seems to be behind and attributes this to difficulty in getting teacher assistance. It appears, then, that it is not the repetition, reinforcement or incremental nature of the activities of the task sheets that is at issue. Rather, Kathy’s concern is with the emphasis on independent work and the management of the lessons, which allow students such as her to fall behind. She resists the classroom culture in 12CPS that emphasises and rewards independent endeavour.

Kathy is contemplating a career as a food technician, or similar work in the hospitality industry. She sees her potential career as “hands-on stuff rather than sitting at a computer typing” (si 21/9/01), meaning she thinks she is unlikely to use computers much in her future work. Consequently CPS is not given high priority in her subject choices. Kathy describes 12CPS as her “bird class” (si 21/9/01) and is unsure whether she will take CPS next year. She is not pursuing an academic course of study and plans to take one UB (University Bursary) subject in year 13. Given her vocational interests it might be expected that the practical orientation of CPS would appeal to Kathy. However, she is uncertain about the worth of CPS based on her 12CPS experience. She indicates that she cannot see herself needing or using programming in the future. Hers is a basic skills and utilitarian construction of computing, which she holds in common with Mr Lucas and her classmates. However, Kathy defines basic skills in terms of office practice – word processing and document production – hence her disgruntlement with 12CPS because of its programming component. What counts for Kathy are the basic skills or tools that fit with her image of herself as a computer user, now and in the future.

Kathy is disappointed with 12CPS. There are aspects of the course that she enjoys, such as word processing, but she dislikes some units, including programming, and the emphasis on individual, self-paced work. The CPS course is not what Kathy thought it would be and she feels inadequate in her perceived lack of understanding and achievement. All these factors combine so that Kathy places a negative construction on her experience of 12CPS.

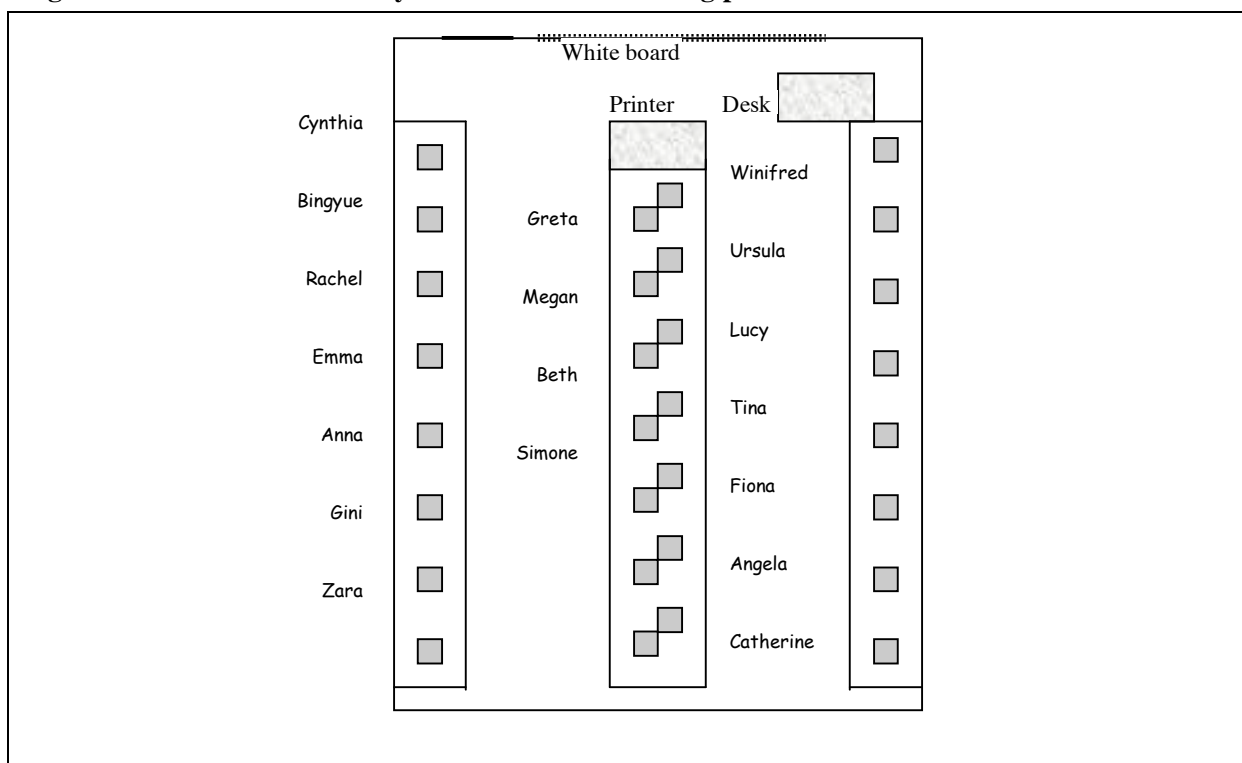
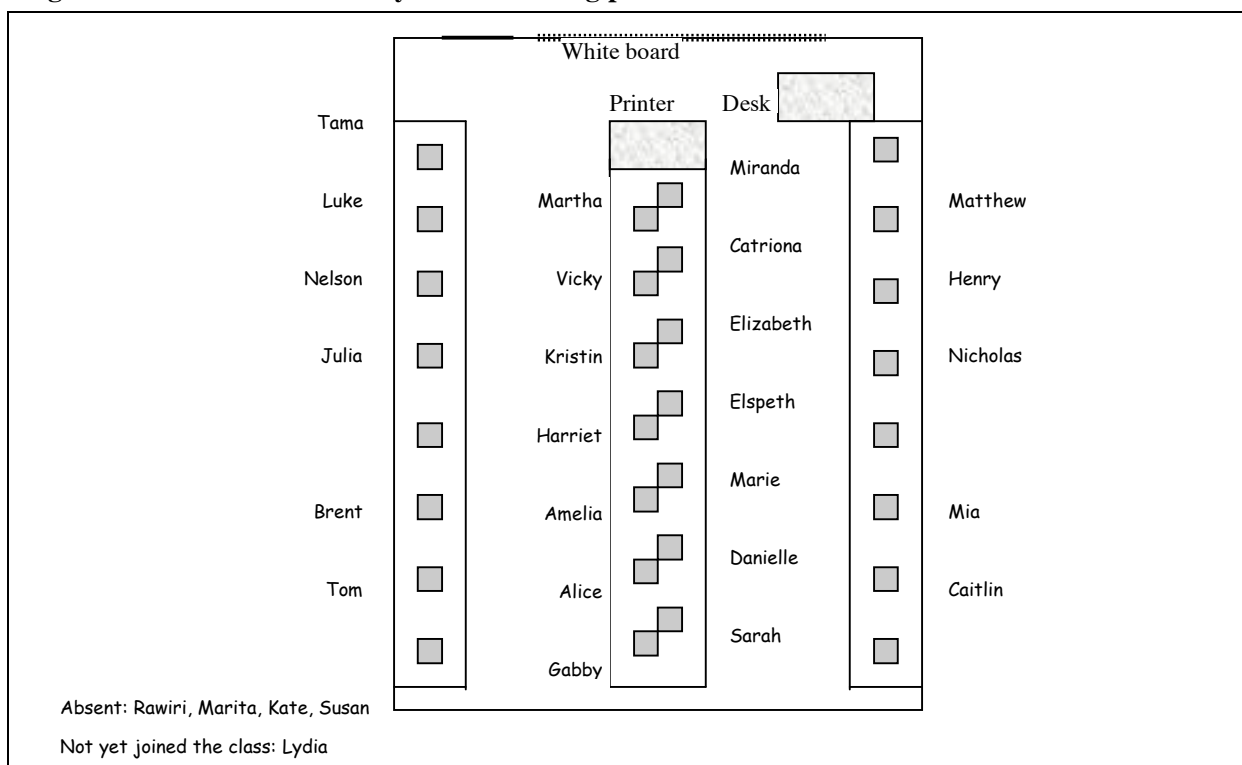
Students in TIM

All six girls comprising the embedded cases in 12TIM express enjoyment and appreciation of the course, although individuals respond differently to particular aspects or components. Two student cases from 12TIM are presented in this section – Angela and Gini. They represent students with contrasting experiences of the 12TIM course. Gini's experience is more mixed and her opinions are more ambivalent than those of the other 12TIM students.

The younger students have varied responses to TIM, both positive and negative. At this level the students have no choice of specialist computer subjects. They take 10TIM or nothing. They are not yet involved with national qualifications and have a range of reasons for taking TIM. The experiences of three student cases from 10TIM are described in this section. These comprise two boys and one girl – Rawiri, Matthew and Vicky. As with the 12CPS and 12TIM cases, the decision to highlight the experiences of these particular students was made on the basis of the contrast they present. These students have different interests in and responses to the 10TIM course. They also constitute a mixed-gender cluster, which differs to the pair from 12TIM. Figures 2 and 3 describe the layout of the TIM classroom and student seating arrangements for 12TIM and 10TIM.

Angela

Angela is observed to work happily and independently on the range of computing tasks presented in 12TIM. She sits towards the back of the room and works on her own when her closest peers are absent from class. She presents as a diligent student.

Figure 2: 12TIM classroom layout and common seating positions**Figure 3: 10TIM classroom layout and seating positions on 2/5/01**

Angela displays a competitive spirit and desire to achieve well. In the focus lesson (ob 28/6/01) she attempts a typing speed test level beyond that of the other students in the class. She takes Mrs Keall up on the offer for her to do the 50 words per minute test as a practice run. Angela seems quietly pleased with the admiration she receives from her peers, even though she is teased by them about her ability.

AK (Mrs Keall): [addressing class] You don't have to type in the instructions [for speed tests]. If it is a heading you do though. All right? So you don't have to type in the instructions. [Angela has her hand up] Angela? Go.

A (Angela): (Can I) --- ?

AK: Do you want to have a go at 50?

T (Tina): Oh, my god! [amazement]

AK: (Do you want to have a go?) I'll go and get the box then_ [long pause; T leaves room to collect box with speed tests]

...

F?: Fifty words a minute? ---

A: I can do 78 [words per minute].

Rl (Rachel): 78?

A: On Mavis Beacon [typing tutor software].

F?: Would you (be) like this Angela? [sound of rapid, exaggerated key tapping]

A: (No) [very quiet].

...

Rl: How long do you get for it?

A: Ah, ten minutes

Rl: Is that all?

A: Ten minutes and (you're) allowed ten errors.

AK: [addresses class] Everybody's got what they want now?_ So everybody is on ten minutes.

F?: (You have) ten minutes to do the 50? [incredulous]

AK: Yes, she only gets ten minutes

A: I (can make) ten errors though.

AK: Right, ready, set, go [speed test begins]. (sc 28/6; tc 28/6)

In choosing to do the 50 words per minute test Angela sets a challenge for herself, but this action is also a public announcement of the keyboarding level at which she is performing. At the end of the typing test, when students are told to stop, Angela continues to spell check her work for approximately ten seconds. She is effectively cheating on the speed test rules in her desire to achieve well. Mrs Keall asks publicly if Angela completed the test, to which Angela

replies that she completed with two minutes to go. This is a statement of fact in response to the question, but it also announces that she can achieve at this level. These actions hint at a desire by Angela to prove her ability, both to herself and to others.

Angela is personally affirmed as a capable and diligent student in her interactions with Mrs Keall. For example:

AK: [to Angela] Yours worked perfectly.

A: Yeah.

AK: Why did yours work?

F (Fiona)? Coz she's got luck.

AK: Luck? Luck has nothing to do with it. Haven't you heard that before?

F?: Yep. (tc 7/6/01)

Affirmation is provided in subtle ways. For instance in one lesson (ob 28/6/01) Angela spends some time working on a history assignment, locating material on the school network relating to Gallipoli. This activity is sanctioned by Mrs Keall and can be seen as an informal reward for being up to date with the 12TIM tasks. Angela ranks her ability with computers as seven out of ten, based on her assessment results in TIM and her experience using a range of applications in different settings – at home, at school and at her part-time work in a real estate office.

When working on class activities, Angela remains focused and tries to maximise her time with the computer. This doesn't mean that she is always on-task. For example, there is a rule forbidding the use of e-mail during class time, regardless of which a number of students, including Angela, surreptitiously send e-mail messages during lessons. Angela is observed to solve problems independently and by trial and error, but to seek help from Mrs Keall when it is apparent that she cannot quickly resolve her difficulties or her immediate peers cannot help. By her own admission Angela doesn't persist with what might be a fruitless pursuit for longer than she feels is constructive.

A: To try and play around with it first. I like to think that I can beat the computer. I don't always but I try, um, and then if I can't do anything with it I'll ask Catherine or Fiona and then if they don't have a clue either I'll ask Mrs Keall, but I like to try and figure it out first myself. If I can. (si 24/8/01)

She seems to find pleasure and satisfaction in solving problems without assistance. She talks of trying to “beat the computer”, meaning to have the knowledge and familiarity with applications that enables her to perform information processing functions and produce documents without assistance.

One thing that contributes to Angela’s positive experience of 12TIM is the accessibility and support of her teacher, Mrs Keall.

A: Oh OK! Um, I think all of it [12TIM] has been pretty positive. When we do something good and we get something right we get a lot of praise and that helps builds some confidence. I don’t think there is anything negative and if there has been, it’s so small, can’t remember it. (si 24/8/01)

Angela identifies with Mrs Keall, having had her as a teacher in previous years. There is a warmth in their relationship born of familiarity. Angela also enjoys what she thinks is a warm and supportive atmosphere in the all-female TIM class.

A: I really like the class and the people. I think, I think we are a good bunch. We work well. I think we work hard and play harder. Yeah I think it is a, a great course to do. It’s a lot of fun and we are getting a lot of skills and also the people are really good to work with as well. (si 24/8/01)

Other factors that contribute to her positive experience include the perceived utility of what she is learning and the incremental structure of activities. These points are illustrated in the following excerpts.

R: Do you like working with computers and why or why not?

A: I like working with them coz I think they are a lot easier to use. I can type faster than I can write so it makes things a lot easier. I think the presentation looks better as well_ That’s why I like working with them. (si 24/8/01)

And

R: ...what applications or topics do you like working with or learning about the best? And why?

A: I think once again Word and the Internet. I think Word is more widely used, (all over the place). Um, the Internet is just so useful for school like_ ---

...

A: Word is just so much easier because – a lot more shortcuts and also (there is) a lot more things you can do with Word. Um, ClarisWorks is, is very simple. It is quite easy to use but you can’t do as much on it and everything is done the long way.

...

R: So are there any *particular* learning activities or tasks you have been given, um, that you have thought have been really good for you?

A: I think the, the whole Finale book. Everything is put simply and you can understand it very easily. It goes through everything step-by-step so you don't feel like you are kind of getting lost in amongst all the instructions. Everything is repeated about three times so you get the hang of it. It's not once and then it's left. It goes over the skills that you have learnt again and again which makes things a lot easier. (si 24/8/01)

Angela sees no reason to question the way the 12TIM course is organised and presented, nor any part of the course content. It fits with her preference for an independent approach to learning. Also, she thinks it is relevant for her future work. She intends going to university, something that is acknowledged by Mrs Keall, and aspires to a career as a journalist. Angela thinks that as a result of taking TIM she has “got the layout skills and_ things to do on the computer that I (want to)” (si 24/8/01). Angela values the emphasis on document production and the computer-as-tool paradigm that defines TIM at KHS because of its applicability to journalism.

Interestingly, Angela does not think CPS would meet her needs even though, like TIM, CPS is a general purpose, applications based course that introduces students to a range of commonly used software. She is convinced that TIM is the more appropriate course for her requirements.

A: I think it [TIM] is very helpful for me with wanting to go into journalism. If I go into print then I have got the layout skills and_ things to do on the computer that I (want to).

...

A: A friend of mine who has a journalism degree recommended TIM over computer studies and said that it would be_ more useful than doing computer studies. It covers more things, um, for journalism ---

R: In regards to desk top publishing and text management? That sort of thing? [Angela nods] (si 24/8/01)

Also, Angela is familiar with TIM, having taken the subject since year 9, whereas she doesn't have previous experience of CPS. She is comfortable with the subject and classroom culture of TIM. These factors combine to dissuade her from considering CPS as a viable subject for her. Angela views herself as a TIM girl.

A combination of factors lead Angela to place a very positive construction on her experience in 12TIM. She believes in the efficacy of TIM, appreciates the way the course is organised and enjoys the social atmosphere of the 12TIM class. Angela is achieving positive results and being affirmed in her efforts as a diligent and capable student. Her experience of TIM has made her something of a TIM devotee.

Gini

Gini thinks that it is important to know how to use computers. She chose to take 12TIM for this reason and says that she would make the same choice again having experienced 12TIM. Although she expresses feelings of frustration with some aspects of the course, Gini has a generally favourable opinion of 12TIM.

Gini claims to be bored working with computers. However, when she makes this claim she is really making a statement about the repetitive nature of activities in 12TIM.

G (Gini): Yeah well they [computers] do get boring and I am the first to admit it. I mean I sit in class and I get *real* bored. But um, nah they're good eh...

R: So, um, Gini when you said that they can get boring but that they are good, what, what makes them boring?

G: Oh, just when you are like um, you know, I suppose because like you are on them, you know, like, what six hours a week at school. And you know you are doing sometimes the same thing for the whole week. Just (everything), my gosh, you know_ Nah but besides that they are all good. (si 28/8/01)

By her own admission Gini often spends a portion of her 12TIM lessons off-task, pursuing social interests and using e-mail, which she enjoys more than engaging in the routine and repetitive activities in lessons. The context of the excerpt below is a discussion about things that Gini finds confusing in 12TIM.

E (Emma): But she [Mrs Keall] told us how to use everything [chuckles].

G: Well I just sit there and just go, ohh.

E: You just weren't listening [laughs].

G: It's the e-mail, I tell you.

E: Yeah, Gini knows how to e-mail very well on these computers.

G: Oh yeah. The one thing I'm good at passing is the e-mail like unit standards.

R: Why is that?

E: She e-mails throughout the period [laughs].

G: I love it. I think it is the bestest [sic] thing ever.

E: And she does writing that I can't even understand. It's that abbreviated text stuff.

G: Oh it's all good. I love it.

R: So what's good about it? Why do you love it?

G: Oh, because you get in trouble for talking so I just e-mail the person next to you or something. It's great. And then um_ I find the Internet quite fascinating actually. I mean it's a lot, it's harder to use at school because there are some things we can get in to and not. Like they are really picky. Like I mean at the moment I am doing an English assignment on suicide and I can't do it through

school, because they don't have the computer set up for that kind of so, yeah but, I just, I love the Internet so between that and e-mail, my class time is great! [humour] (si 28/8/01)

It seems, then, that Gini resists engaging with content and activities that she finds uninteresting. She chooses to pursue that which she enjoys rather than persevering with that which she finds tedious. E-mail provides an opportunity to subvert classroom rules and pursue social contacts. She resists but doesn't question the way the 12TIM course is organised and presented, implying that the course structure is a given factor and isn't something that she is concerned about or thinks it fitting for her to criticise. The closest she gets to criticism is to describe some activities as boring.

Gini is part of a social group in 12TIM that she and others perceive to be relatively naughty. She regularly sits with Emma and Anna and they appear to be good friends. Mrs Keall identifies this group as troublesome and rues what she thinks are poor attitudes and application to work compared with other class members.

AK: ...And then you have got the, um, ones like Anna and Emma. They seem to get on quite well. Anna seems to be the, the problem in that class. She causes a lot of the disruption and also, um, Gini. Gini is not focused at all. You know which one she is? The blonde girl.

R: Mmm.

AK: She is really into sport. Never there. She said to me the other day, I'm in fifteen school photographs for sports, so you get that_ you know, she's just into her sport, she's not there for_ do a lot of learning I don't think, and she disrupts Emma, who is on one side, and then of course there is Anna, and ah, that is why they sit together I'd say, for a bit of a chat sometimes. And they are the two that will, ah, "But I don't know how to do this", and you have just gone through the whole process and they are the two who will put their hands up. "I don't know what I'm doing". Yeah. Which is most frustrating. (ti 21/8/01)

Mrs Keall's irritation is evident in the number of reprimands issued to this group. They receive more reproofs for inattention than others in the class. Thus Gini and her immediate peers receive subtle messages of disapproval regarding their behaviour. However, the girls accept these reproaches as fair and I sensed no strong tension between them and their teacher that negatively impacts on their classroom experiences.

During and prior to the time of the classroom observations in 12TIM Gini is absent from class for a number of lessons due to illness and sport commitments. This means that she is less familiar with features of the applications on which the computer activities are based than are other members of the class, which is a source of frustration for Gini and her teacher. Whilst

Mrs Keall provides assistance to Gini and guides her towards particular tasks, suggesting that she leave out some activities and complete others so that she has practice with procedures and skills that will be assessed, Gini shows some confusion about what she is doing and where she stands in relation to the completion of assessment tasks. She is also aware that she isn't performing as well in assessments as others in the class. Although she seems to have a relaxed attitude towards her 12TIM studies Gini cares about her results and gains satisfaction from achieving well in assessments, and commensurate disappointment from a poor performance.

G: Something positive [in 12TIM] would be passing like the e-mail unit standard on the second time. Like no one passed it on the first time. Everyone just messed it up ---.

E: Has she told us that we passed it yet?

G: Yes, and I was very happy.

E: I didn't, did I [pass it]?

G: (I don't know) --- Um_ I (no), oh, when, when we got our grades, for our what were we (are), sixth form [certificate], I think I got a [grade] six or something. I think it was a six, and it just put, you know, I just thought oh my god. What was the point of this, you know. Because I was (like), I think_ I think the first, at the start of the year, I was talking, I might have been talking more, and we had, what was the first assignment we got?

E: I don't remember.

G: I know what it is, oh, nah I can't remember but any way, I got like 50 something, 54 in it or something which is_ not that good compared, because our class is pretty good I suppose. But yeah and then I got my grade and it was like real_ crap coz, and it made me think, you know, what, what is the point in trying in typing. But yeah I think I have done better in the last two things, the last two assessment thingies that we have had, but yeah. (si 28/8/01)

Gini attributes her poor performance to her own behaviour, specifically her talking and lack of attention.

At this stage Gini is unsure about what she wants to do on leaving school, but says it will be something to do with sport. She aspires to be an international athlete and dreams of winning a medal at the Olympics. She has pursued TIM this year and in previous years because of its perceived utility – “you are always going to need typing somewhere along the line” (si 28/8/01). In a similar vein:

G: ...It's_ it's also like a back fall as well. Like for example if you, you know, you want to be chef or something when you finish school and it doesn't work out you have always got your computer to fall back on, which my Mum said from the start as well. (si 28/8/01)

Thus, Gini sees TIM as a general utility subject and a sensible option for someone who doesn't really know what she is going to do for a career. Gini values 12TIM for its

expediency, even though she is not particularly engaged by the course. Other things in life, such as sport, hold greater interest for her.

It appears, then, that Gini's experiences in 12TIM are characterised by a complex mixture of success and disappointment, enjoyment and frustration, interest and tedium. This is reflected in her behaviour in class, which fluctuates between conscientious attention to the task at hand and distractedness. She likes and values TIM, but not with the devotional intensity of a number of other students in the 12TIM class.

Rawiri

Rawiri's time in 10TIM and prior computing experience has not inspired an especial liking for using and working with computers. He likes the 10TIM course and class, but he doesn't see himself pursuing further specialist computer education or work that will entail extensive computer knowledge. He expresses an interest in being a teacher or a policeman, but he is unsure about the type of computer work entailed in such occupations. Rawiri thinks he might use computers in his future working life, for things such as file management and word processing. He says that he chose 10TIM as a subject on his father's advice that "computers will be more in the future" (si 31/10/01), meaning that familiarity with and ability to use computers will be increasingly important in daily life. The impression is given that Rawiri took 10TIM because he thought he should rather than because he was, or is, particularly interested in learning about computers.

When asked to identify positive and negative experiences in 10TIM Rawiri can think of nothing negative but concurs with Luke that not having a computer at home constitutes a disadvantage, because he is less likely than some students to have previously encountered some of the applications used in 10TIM. Rawiri's family has recently acquired a computer, which he says he uses mainly to play games. The components of the course that Rawiri likes best are opportunities to use and learn about the Internet and to create data shows, which he thinks are fun. He suffers activities that he thinks are boring, which include the routine keyboarding and text entry components of 10TIM. Rawiri is interested in TIM and in using computers to the extent that it provides opportunities for entertainment and it makes schooling fun.

Rawiri does not think of himself as skilled or knowledgeable about computers and his experiences in 10TIM reinforce this idea.

R: ...imagine a scale where one is not very good and 10 is really good, like excellent, where would you put yourself and why would you put yourself there?

Ra (Rawiri): Oh I'd get a four or something because I'm not very good at it.

R: What leads you to say that?

Ra: Oh I don't know. I don't really listen to the teacher when she_ oh, not really, yeah. I get bored and it's like, yeah.

R: Are there any things that you think you are better at than other things?

Ra: No, not really. Oh, no not really. About the same.

R: What about the same as Luke? (Is that what you said?)

Ra: Yeah, kind of. I might be a bit lower than this guy [Luke], yeah but_ [R chuckles]

R: Oh. So is there anything in particular that has made you think like, you said that you were about a four. Is there anything in particular like that's happened or any particular events or things that make you think that you are not so good?

...

Ra: I can't type that fast. Like the other students in_ the class. (si 31/10/01)

He states that he is not going to take TIM next year because other subjects would probably be better. He says that he thinks he could pass in other classes, like Maori, physical education and cooking, but that he is not very good at typing. By implication, Rawiri expresses doubt that he would gain a passing grade in year 11 TIM. Rawiri judges his ability primarily on his typing skills. He is a two-finger typist and looks at the keys when keying in information. He experiences 10TIM primarily as a typing course. Rawiri sees himself as a poor typist and therefore as a poor TIM student.

In some of the lessons observed Rawiri seems to work happily on the tasks set. In others he seems downhearted and to experience little enjoyment or satisfaction in the tasks. It is apparent from observing him in class that he depends quite heavily on those he sits with to help him complete classroom activities. In fact, he sometimes uses his peers to do things for him, thereby faking knowledge or familiarity with different applications while completing task requirements. In one lesson, when the task is to create an invitation using the draw function in MSWord, Rawiri regularly interrupts Susan, who is sitting next to him, to ask her how to perform different operations and to check that he has done things correctly – “Does that look all right?”, “How do I do it?”, “Can I make it bigger?” (ob 6/4/01). Sometimes he asks Susan

to do things for him, such as creating a frame and inserting colour into the background. At other times Susan spontaneously takes over the mouse and shows Rawiri how to do something; for example, adjusting the size of a frame. In this lesson Susan acts as Rawiri's personal consultant and is regularly distracted from her work by him. It isn't that Rawiri is unable to perform the tasks, given support. In fact, Mrs Nugent identifies him as one of the more able students in his whanau peer group. Rather, Rawiri constantly seeks advice and confirmation that he is doing the right thing and looks to social interaction to solve problems. He quickly becomes frustrated when he encounters difficulties and habitually turns to people for assistance. He is the antithesis of the stereotypical socially isolated, individualistic, independent male computer geek.

In other lessons (ob 18/5/01 and 5/9/01), Rawiri shows frustration that interaction with his neighbours is restricted. While doing a test pertaining to word processing he briefly and secretly consults with the girl sitting next to him on two occasions, one time asking her what the instructions mean. He is frustrated at not knowing what to do and being confronted by unintended results on screen, which are greeted with expletives – “Oh, what?”, “Oh, bum”, “Oh, shit”, “No!” (ob 18/5/01). Rawiri doesn't seem to know how to perform some of the test tasks, including justifying paragraphs and setting different margins. He was absent for several sessions before the test, away on a field trip, and is upset by the prospect of an assessment – “Miss, I don't even know about this test... I don't even know what its about... I wasn't even here” (ob 18/5/01) – despite assurances from the teacher that he was present for the sessions on paragraph styles on which the test is based (tc 18/5/01). At the end of the session he reveals feelings of inadequacy when he says to his neighbour “Far (out). You're fast! I'm slow this period.” He adopts an I-don't-care attitude, which acts as a cover-up for concern at his failings.

In contrast, Rawiri works more constructively and happily on a composition task in a later lesson observed (ob 5/9/01). Students are directed to list a selection of movies they have seen and are asked to write about one movie. In a second task they are asked to identify and write about people that they admire. The instructions for the composition task emphasise structure and accuracy in the document layout and written expression. Students are required to set up the page as instructed, which means including a heading, presenting a list, setting margins and

centring text vertically; also, to ensure clarity of expression, sentence and paragraph structure, spelling and grammar, and the use of imaginative language. Rawiri settles to the task and appears to engage happily with the design and pictorial features, such as creating a heading using word art and inserting a picture in the text. He knows how to use these functions. However, he is less attentive to the language components of the task. Rawiri seeks the approval of Mrs Nugent. For examples, he asks her “Is that a good title?” and receives her approbation, along with advice on the use of capitals in headings and use of the personal pronoun “I”. He is less demanding of those around him in this lesson than is observed in some others. He appears to enjoy the design component of the task, the context of the activity (movies) captures his imagination, and he is sitting next to a girl that he doesn’t seem to know very well and seems reticent to interrupt.

Rawiri carries with him stereotyped expectations of behaviour and ability that go with being part of the whanau class at KHS, a homeroom class for Maori students, which helps define his experience in 10TIM. The whanau class exists to support Maori students, theoretically providing a learning environment within which they feel more comfortable and within which they are likely to achieve improved academic results. Whanau class members are thought to be more disruptive than other students.

CN (Mrs Nugent): ...Today we have lost the whanau group, and they're away 'til Friday and... they're generally the more rowdy, but not in a nasty sort of way, the more rowdier kids. (ti 15/3/01)

Rawiri identifies himself as a whanau class member and his bold behaviour is seen by himself and other students to be an identifier of membership in this class.

R: Is this class [10TIM] different to other classes or pretty much the same in the way that students get on and act?

Ra: For me it's different cause I'm in the whanau class.

R: Yeah. So what's different Rawiri?

Ra: We tend to_ oh_

Lu (Luke): Act up

Ra: Yeah.

R: In this class or in the whanau class?

Lu: Whanau class.

Ra: Yeah. And we, um, and with the mainstream teachers they can't really handle us, you know, um, and the whanau teachers can. Yeah so, we are a lot naughtier in the mainstream.

R: Do you think that, um, so is this class here [10TIM] different to mainstream?

Ra: Yes. (si 31/10/01)

Rawiri's membership of the whanau class means that he stands socially apart from most other class members in 10TIM, even though he interacts with a range of students in the 10TIM class. However, he distinguishes 10TIM from other mainstream classes, implying that difficulties in managing whanau students are less acute in this practical class than in other mainstream classes. He concurs with Luke that Mrs Nugent is a good teacher, partly because of her management of the 10TIM class. It is implied that his relationship with the teacher and the structure and practical nature of 10TIM are positive features of his experience in this course compared with other mainstream classes.

Rawiri places a generally positive construction on his experience of 10TIM, even though he is not interested in pursuing the subject further. This derives from his enjoyment of particular aspects of the course, including the use of Internet search engines, and a perceived need to have some experience of computers to equip him for life. Also, he responds positively to the teacher. Pedagogical arrangements provide both positive and negative experiences for Rawiri. He enjoys opportunities to work in tandem with his peers but is frustrated when forced to work independently. He experiences 10TIM primarily as a typing course and perceived inadequacies in his keyboarding skills lead him to reject TIM as a viable option for further study. His experience is thus of fun with computers, tinged with feelings of inadequacy and failure as a 10TIM student.

Matthew

Matthew likes computers and values the 10TIM course for the opportunities provided to work with and learn more about using them. He attests to having had a personal interest in computer technology from a young age.

Mw (Matthew): I like computers but I don't really have a reason. I just was interested. They have just always interested me_ I just like technological stuff.

...

Mw: I've always liked playing with them.

...

R: What do you do with that [home computer]?

Mw: I play my games.

R: OK. What sort of games?

Mw: Um_ RPG's

R: Can you explain that for me?

N (Nicholas): Nobody knows what they are! [chuckles]

Mw: Role playing games. Flight of fantasy and stuff. Complex. (si 26/10/01)

He prides himself on being a self-taught technological expert.

Mw: Everything I've learnt with computers I've just taught myself.

R: Yeah

Mw: Like for installing, de-installing, moving things, I taught myself.

R: You said installing_

Mw: Installing stuff and moving things around, deleting, reprogramming a computer. I did that all myself.

...

R: OK. So when you were talking about installing, you were talking about installing software_ ?

Mw: Games, software and games, Encarta, ---.

R: And so moving them around is that moving them around within_

N: Into folders

Mw: Yeah in folders, hard drive, putting (in) different hard drives. (si 26/10/01)

And

R: So what made you interested? Like if, if at home your parents aren't that interested in the computer_?

Mw: Oh, I don't know. I just started just teaching myself and they got a computer and I started fiddling around in it_

N: Like you do in your spare time

Mw: Mm. Yeah, screwed up most of the time [chuckles]. (si 26/10/01)

Matthew talks of fiddling around "in" the computer. This signals an interest in computers for their own sake and in how they work, in contrast to a purely utilitarian interest in what they can do and in gaining familiarity with applications such as word processing or graphics. He wants to be a computer programmer on leaving school.

Computers are an integral feature of Matthew's daily life, comprising a work tool and hobby. He says he uses computers every day, for gaming and to assist with homework, which involves accessing information from CD ROM databases, such as Encarta, and the word processing of assignments. He doesn't have Internet access at home, but anticipates getting it

at Christmas, which he looks forward to. He likes playing “spacey games” the best because it “passes time”, but says that Encarta is the most useful application because he uses it regularly to complete his homework for different subjects (si 26/10/01).

Matthew rates his ability in 10TIM as ten out of ten. He is confident that he has a good understanding of the applications that comprise the content of 10TIM.

Mw: ...I know how to use Word and everything. Just spreadsheets I have a bit of difficulty with, just learning all the new things_ how to convert and all that.

R: OK. When you say convert_?

Mw: When you want to make change like from currencies and everything, and all that. (si 26/10/01)

He sees himself as better than most of his classmates. He identifies the teacher and Henry as those whom he would ask for assistance if he had problems with an activity in class, implying that aside from these people there are few in the class who have superior knowledge to him.

Matthew thinks of 10TIM primarily as a typing course.

R: ...What style or types of things do you get to do [in 10TIM]?

Mw: Just typing. (si 26/10/01)

For him, the emphasis on keyboarding in 10TIM is tedious and, it is implied, extraneous to his particular needs and interests.

Mw: Things from sheet onto a computer is real boring. If we had a free rein to do what we want_ instead of doing ---

...

Mw: Working for your friends is positive. It builds a relationship [jesting; mocking]. Negative, it's really boring at times [chuckles].

R: And are there any particular things that you think are boring?

Mw: Typing. You know like copying from a sheet onto the word processor. It is really boring. (si 26/10/01)

The tone of the conversations between Nicholas and Matthew suggests that for these boys it is cool to be critical of the word processing and keyboarding components of 10TIM.

Nevertheless, Matthew thinks the course is useful and enjoyable. He says that he likes 10TIM “most of the time... It is OK” (si 26/10/01). He chose 10TIM because he thought it would improve his computer skills and plans on taking TIM next year “to keep on improving my

skills” (si 26/10/01). He is unsure whether he will take TIM or CPS in year 12. Matthew says that he doesn’t know whether there are opportunities to learn about programming at KHS and anticipates that he will learn to program computers at university. For Matthew, 10TIM is an early step in a programming career path. It is a means to a long term goal.

Matthew is affirmed in his knowledge of computers through his interactions with his peers and the teacher of 10TIM. He is consulted by those he sits beside about how to perform particular operations and is called upon by Mrs Nugent to assist his neighbours. He shows understanding of the principles behind different functions when responding to queries. For example:

To (Tom): Matthew. That wouldn’t be on the page, eh, because of that?

Mw: What, that (red art) thing?

To: No. That, that bit there wouldn’t be on the page would it?

Mw: Is it in print preview?

To: Yeah.

Mw: Yeah, it probably will be.

To: Oh, yeah. Cool.

Mw: If it’s showing it in print preview it probably (would).

To: Good. (sc 7/9/01)

Matthew approaches tasks set for the 10TIM class confident of his ability and he uses trial and error to solve problems and find out about different menu features. Nevertheless, he also consults with those with whom he sits in different lessons, including Susan, Vicky, Julia, Tom and Henry, as a quick and easy option for finding out how to do something. Matthew works diligently on the document production activities, even when resisting or complaining about them.

Observation of his classroom interactions reveals a tension between Matthew’s earnest interest in computers and TIM and his desire to conform in his peer group, which means being critical of TIM. In a lesson observed later in the year (ob 7/9/01) he is argumentative and scornful of the composition activities the class are required to complete. Students are engaged in two activities, the creation of a poster for Reading Week and the completion of letters from a previous lesson. Whilst it is possible that some of Matthew’s behaviour is a performance inspired by the presence of a microphone and of a stranger in the class, it is also possible that

peer pressure emboldens him to express ideas that are subversive. He agrees with a girl sitting nearby that the teacher is “fussy” (sc 7/9/01), meaning that the task requirements are pedantic. He concurs with Tom that the activities are boring. Tom is disparaging about the composition activities and Matthew acquiesces to Tom’s views. Matthew is learning in 10TIM that it is good for boys to be disinterested in typing and text/language composition tasks. He resists an instruction from Mrs Nugent to write a fourth letter, although he does ultimately settle to the task. Also, Matthew makes changes to his poster in response to a comment by Mrs Nugent that the dates in his poster need to be filled in so as to make them easily visible at a distance, but he gives the impression that he does this because he is directed to, not because he has any interest in the task or is concerned about the look of the poster.

Matthew construes his experience in 10TIM in positive terms. He is disposed to think favourably of 10TIM, given his fascination for computers. The course provides an opportunity for Matthew to pursue his computer interests at school and comprises an introduction to computer applications that is of general interest to him. It is also a subject where he feels confident and has the satisfaction of achieving very good results. However, Matthew experiences a tension between the utilitarian function of TIM and the construction of TIM as office practice. He is comfortable with the utilitarian form of TIM but resists the keyboarding and composition components of the course. Matthew is learning what it means to be a male student of IT, and this means favouring some applications and activities in 10TIM over others.

Vicky

Vicky thinks of 10TIM as a useful introduction to common computer applications. She has pursued the subject because she thinks it will assist her in the future. However, she is unsure if she will take TIM in year 11. It may give way to other subjects. For Vicky, TIM is not a priority subject or a critical component of her secondary schooling.

R: Do you think you are going to have the skills you need after this class, after this course, 10 TIM?

V (Vicky): Um, there is probably a few things that you won’t know because each, like, job has different things they need on the computer, but you have a rough idea of what you are doing to go about it.

H (Harriet): It depends how much of, how much of a computer you need to use.

R: Mmm. Do you think say after you have taken it next year Vicky, assuming you are going to take it, [students chuckle] that you would have enough at that point or are you going to need to go on and do more computing do you think?

V: Probably_ yeah I don't know. I might have enough at that point. Because I can always go back and take --- after school. Like there are heaps of classes with computers. --- It's kind of hard to tell. (si 2/11/01)

Vicky wants to be a zoologist and thinks this would not entail as much computer work as many other jobs and that it would primarily involve using computers to write up notes about animals, such as their diets. Her priority is with academic subjects and she views a computer as a tool to assist her in her work, something she needs to be able to use but not necessarily understand the workings of in great detail. In saying that she can “always go back” and acquire further computer skills if dictated by circumstance at a later date, Vicky signals confidence in her ability to acquire whatever practical computer knowledge is necessary. She also intimates that she thinks doing courses in IT is a matter of getting training in particular computer uses or functions and that this would not be especially difficult to achieve. Vicky implies that IT courses are lesser, albeit useful, options compared with the academic subjects that are her schooling priorities.

Vicky's is a utilitarian interest in learning about computers, and a utilitarian assessment of the efficacy of 10TIM. She says she likes working with computers because she can produce work quickly and set it out neatly. For her, the main value of a computer lies in document production. She expresses a preference for aspects of the 10TIM course that allow originality and creativity in document design and presentation – “And you get, you can make it like different, like the titles and everything. You can make it look good as well but it's really simple” (si 2/11/01). She finds the keyboarding component of the course tedious.

R: Anything else that you think is really good?

...

H: Yeah we made like party hats and that. It was like fun but we still learnt how to use all the applications.

R: What is interesting or fun about that? Because you both mention things where you're kind of_ using pictures and drawing things. Is there anything in particular about that_?

H: The colour of it and_ just, it just_

V: Yeah it sort of, like gives it a change, like looking for a picture instead of just sitting there just constantly typing out things off a sheet. Yeah.

...

V: Well I know the thing that I found most boring [negative] was copying out sheets of paper. That was like boring. (si 2/11/01)

Her preferred unit of work in 10TIM is the one where students use PowerPoint to create slide shows. Thus she favours the construction of TIM as creative practice.

Vicky rates her ability with computers as “somewhere in the middle” on a ten-point scale. She sees herself as a competent user who “sort of” knows how to manage files on a computer but who lacks the knowledge to solve problems “if it goes really wrong” (si 2/11/01). However, she speaks with confidence of sending information *via* e-mail and incorporating material such as pictures into Word documents. She feels that she is good at using Word, “because we have done it at school”, presumably in 10TIM, and finds using this application “easy” (si 2/11/01). Likewise she expresses confidence to use Excel, a spreadsheet application used in 10TIM. However, she is less assured about other applications, such as databases, that she has had little or no experience of at school or home. She signals that she doesn’t have database or spreadsheet software on her home computer. She uses her home machine mainly to word process assignments and to communicate with friends by e-mail. Also, but to a lesser extent, she uses it to play games, which include car race and a flight simulations.

Despite her ambivalence about her broader computer skills, Vicky sees herself and is viewed by her peers as a competent computer user in 10TIM, one of a group of six girls who know what they are doing and regularly complete tasks ahead of others – “Basically her [Vicky’s] friends and my friends are probably roughly the top_ top of the class” (Harriet, si 2/11/01). Vicky talks of consulting with her female friends, Matthew or the teacher when she encounters difficulties with computer tasks. Class observations confirm that Vicky and her friends work in parallel, checking with and volunteering assistance to each other throughout lessons, even when they are separated according to a seating plan. In one of the lessons observed (ob 11/5/01), Vicky assists two girls who are sitting near her, Susan and Lydia, but who are not part of her close peer group. However, when she wants assistance for herself, Vicky turns to her friend Julia, who is sitting behind her and several seats away. Vicky interacts and identifies mainly with a group of confident, academically oriented girls who are amongst the highest achievers in the class.

Vicky places a positive construction on her experience in 10TIM. She experiences pleasure in the camaraderie of friends in the class. She experiences success and displays self-assurance in her ability to use the applications used in 10TIM. Her confidence is tempered, though, by doubts about her knowledge of computing beyond the business of 10TIM. She values TIM for providing grounding in the use of computers and common applications, particularly of MSWord, which she uses regularly in her daily life. Her experience of 10TIM leads her to view the course as a useful addition, but not an essential course for an academically oriented student such as herself. She values TIM as an introductory IT course but does not cast herself in the mould of a TIM girl like Angela.

Factors in students' experiences

The experience of individuals participating in the same specialist IT courses varies. It is possible, though, to identify some factors that are common influences in students' experiences. The factors described below are those that emerge as defining features of students' experiences in CPS and TIM classes at KHS.

Expectations

A key factor in students' experiences of specialist IT courses is the extent to which their expectations of course content match what is presented in class. A related factor is the extent to which the content and skills that are presented in the courses are relevant to students' post school aspirations.

For Ben, a source of disgruntlement and disappointment with 12CPS is that the course isn't what he expected.

Bn: ... --- computer studies, sort of, sounded a lot more like you would learn more about the computers and putting them together, which I was *wrong*_ I, I thought because_ you know I thought it would teach me about the_ the components and chucking them together and shit like, stuff like that.

R: And that's what you wanted?

Bn: Yeah, that that's what I wanted but I didn't get that_ Oh well. (si 17/10/01)

Ben's image of what CPS should be is of a technical, computer science construction of computing.

Lisa and Kathy also expected something different of 12CPS, but their expectations are different to Ben's.

R: ...what it is that you thought would be different, compared with what your experience has been.

L: Well I thought, you know how you get the big menus when you, I thought you would probably just go through and learn what like all of them were. Just like we could go into Word, go into Works, just learn the basic stuff.

K: Yeah

L: And then you'd, he'd show us a different program and say this is the basic stuff in here, maybe give us a few exercises and then he'd choose basic stuff on something else and then we'd get to learn to use the Internet correctly, maybe, and_ just basically learning more about the actual computer, not about making a computer program or_

R: When you say learn about the actual computer_?

L: Like what's in it. Like just everything_

R: Like?

L: Not what's in it. Not like the technical_ this is a motem [modem] or whatever, but just the programs and_ And the different things that you can find on there and_ yeah.

...

L: I thought it would be like a mixture of sort of the technical graphics and things.

K: Yeah.

L: And typing and just everything. (si 21/9/01)

And

K: Yeah. I don't see the point of lots of programming_ having_ doing all this stuff on how to draw squares and lines and_

L: And gosub [programming term].

K: Yeah, see I'm not going to use that. Yeah. So I don't see the point.

R: So the things that you like the best, does that, is that because you feel it's more useful or just because its easier?

K: Yeah. Both.

L: No.

R: You've used that word easier a few times.

K: Oh well_

L: Just because it's useful. Coz it wasn't that easy to start with – the spreadsheet and the database.

K: But we are gonna use that more than we are gonna be able to use gosubs and_ for drawing squares and robots.

L: Unless you want to do programming.

K: Yeah. Unless you are doing that kind of stuff but_ yeah, I'm not so I'm not going to do that. (si 21/9/01)

What Kathy and Lisa mean when they say that they expected to learn more about computers in 12CPS is that they want to learn how to use a range of applications related to document production, to develop their keyboarding skills, and to become familiar with and be given opportunities to access the Internet. Learning “more about all the stuff that is in the computer” (Kathy, si 21/9/01) doesn't mean learning about the hardware and operating systems. Rather, it means being exposed to different versions of generic computer packages, such MSWord, and the various functions available in the application menus. A spontaneous comment reveals that Kathy thought computer studies would be more related to “business type working, office type stuff” (si 21/9/01). Her conception of computer studies is based on an office practice model, which is not her perceived experience in 12CPS. Her image of what CPS should be is more aligned with the TIM construction of computing at KHS.

These girls react negatively to the programming component of the 12CPS course. They see no relevance for programming in their lives. Lisa responds with cynicism about the worth of programming when she is asked what she is doing during a lesson.

R: Are you still working on programs?

L: Yes. Sucks!

R: [giggles] Why is that?

L: It's boring and I don't see why you need it, coz how are we going to use it?

J: To write programs of course.

L: Coz I'm going to write a lot of programs! Woo! Yeah. Don't know where I'm up to. Right, I'm your friendly computer and_

J: Oh, that one. [chuckles] I just suggest, I think ---

L: List. Woo!

...

L: Oh, I'm confuuused!

J: You're confused! --- I'm confused.

L: Oh, it's only this stupid crap. (sc 11/9/01)

Lisa wants to pursue a career in broadcast journalism and sees no personal reason to learn about programming. The disjunction between her expectation and her experience in 12CPS leads to disappointment with the course.

In contrast, Xiao-hong speaks favourably of 12CPS. She wants to pursue a career in business or IT and plans to take computer courses at university. She thinks that the programming component provides the most important skills for her future work. When asked what has been a positive experience for her during the year, Xiao-hong expresses pleasure at getting a good mark for a recent programming test. It may be that she selects this incident because it is a recent achievement, and consequently more current in her thinking, but other comments show that success in programming is very important for her. She indicates that she doesn't yet understand much about how computers operate and that she finds the programming component of the course difficult, but she judges 12CPS favourably for its programming component, which she considers to be highly relevant for her future life and career.

Others are similarly disposed to appreciate 12CPS because of a perceived congruence between their vocational interests and the content of 12CPS. For example, Mason's intention to pursue a programming career means that he looks favourably on the course. Carl wants to be a computer technician. He says that he thought 12CPS would be different – "I was expecting computer studies here is like_ hardware" (si 14/9/01) – but he nevertheless speaks well of the course. He expresses an interest in programming, implying that such knowledge will be useful for him in the future, even though he finds this aspect of the course more difficult than some others. Carl feels that the 12CPS course is compatible with his needs, despite a perceived lack of information pertaining to computer hardware.

The girls in 12TIM express general satisfaction with the content of the TIM course. They appreciate the relevance of the content to their daily lives and anticipated post school pursuits. For example, Winifred expresses interest in learning about a range of applications, such as MSWord, PowerPoint and Excel, and pleasure in typing and producing items such as newsletters and brochures. She talks of the applicability of such skills in other subjects.

W (Winifred): I found word processing and Excel because like this year --- you know how (you) turn the figures in to a graph and you don't really have to draw it yourself. Yeah, I learnt how to do that. That was cool.

R: So you think that's particularly useful?

W: Yip, because not only in TIMs, but I use it in accounting, economics for assignments, turning it into graphs, and biology sometimes we use it.

...

W: It's good skills that you learn from TIMs isn't it? And you know that you are going to use it.
(si 29/8/01)

Winifred isn't sure what she wants to do when she leaves school, probably something in business where she can be her own boss, and she isn't clear about what skills she will need for her job. She indicates that she thinks she will probably "have to love how to build a computer" (si 29/8/01). She signals that she doesn't currently know much about the components of computers and how to put them together, and implies that she doesn't have a passion for this type of activity. She is, however, very satisfied with the knowledge of general purpose applications that she is gaining in 12TIM, primarily for the utility and applicability of this knowledge in her daily life.

Beth's experience of 12TIM is similarly congruent with her general computer use and vocational aspirations. She indicates that she spends a considerable amount of her leisure time in chat rooms and surfing the worldwide web. Understandably she appreciates the components of the course that make her more familiar with the Internet.

B (Beth): I think the one (research activity) that we are doing now, the e-mail thing. That's my favourite – even though it was frustrating me, um, it helps me learn (all) about the Internet and stuff. So, like I can now understand it better, so_ (si 29/8/01)

Also, Beth wants to work in the travel industry, as a flight attendant or travel agent, and makes a utilitarian connection between what she is doing in 12TIM and her likely future work

B: Um, I think (the) database is useful for me because now like I will be able to go into (things and check things up) and then change them without having to rewrite the whole thing.

R: How are you likely to use the database?

B: Well if I'm like a travel agent or something and I am looking for a certain person, I will be able to find it and not have to go searching through all these things.

...

B: ...hopefully I'm going to a [travel] school next year. And um, I already sort of know what I'm going to need, but they teach it there. Like, I am going to have to learn how to use Galileo [a ticketing system] and things like that but I've already done a lot of --- that. (si 29/8/01)

Similarly, for Susan there is a close link between the work done in 10TIM and her likely vocation. She is one of a few girls who identify closely with a traditional office practice career path.

Sn (Susan): I thought it [TIM] would help me in the future because I want to do something to do with computers. Maybe not computers but typing out things, maybe a secretary. I don't know. Coz

I think that everyone needs to have computer skills and that's why I'm taking it next year. I'm definitely taking it next year no matter what. (si 21/11/01)

She says that she likes “typing and stuff” (si 21/11/01) and really likes the 10TIM course. The connection between TIM and secretarial work gives relevance and immediacy to her work in 10TIM and contributes to her enjoyment and appreciation of the course.

These examples illustrate how different students' expectations of specialist IT subjects and their career aspirations may or may not be congruent with the content and form of specialist IT courses of their experience. The level of congruence helps to define their experiences. It influences the constructions they place on their classroom encounters, whether positive or negative.

Prior experience

Prior experience with computers helps to define students' current experiences with IT and of IT courses. It means that different students are more or less familiar with the hardware and software that is used in class. They have prior knowledge that affects their levels of confidence or self-efficacy when using computers in CPS and TIM classes.

Students experience different levels of comfort or anxiety when they are required to use computer technology and to solve problems that they encounter in specialist IT classes. Learning about different software is a matter of learning a range of commands and the specific logic of the instructions required for different applications. To use a language metaphor, it is about learning software dialects. The precision of this language is a source of frustration for students. However, what constitutes difference in students' classroom computing experiences isn't so much the hardware and software *per se*. After all, the students in each specialist class use the same hardware and software. Rather, it is their prior experience with computers and the differences between the technology used in class and that with which students are already familiar. For example, Gini is more familiar with a Macintosh computer, which she has at home, and expresses discomfort at having to use a PC in 12TIM.

G: Well like knowledge of the computer, like knowing where things are I can do real easy. I mean I have been brought up with computers at home and I just, I love fiddling round and finding new

things but when it comes to the typing, drawing and stuff I'd probably kill myself. I'm about a five or a four or something, you know. I like get stuck with, especially with the new ones [PCs] now in there. You know, I just sit there and I just look and like, huh_

R: So when you say you are getting stuck, are you getting stuff with particular details?

G: Just knowing where, like if it says, you know to set the tab or something. I'm not too sure yet where to find everything.

R: And when you said at home that you get lots of, you know that you use them quite a lot and you have got them at home and you are quite good at knowing things about the computer, can you elaborate a little bit there? What sorts of things about the computer?

G: Or just um well like when I'm doing the writing and stuff, I know where to find you know, my little draw tools, tool bars and you know the double line spacing, centring and you know, lettering and all that. It's all, I find it easier to use the one at home for writing and stuff.

R: So is that, so_ the distinction there between the one at home being easier than the one here, is it just because it's a different program?

G: Yeah. Like the one that we have got at home is a Macintosh - the ones we used to have here and then they changed them all round so it was like two different styles. (si 28/8/01)

It is the idiosyncrasies of the software, differences in the menus and the location of features, that are the source of Gini's frustration. She has to spend time learning how to perform some functions over again on the computers used in 12TIM, which causes aggravation. For example:

AK: [to Gini] OK you need to revisit your margins.

G: My margins?

AK: Yeah. How do you change a margin?

G: God I don't know. I did it like last term. [shows annoyance]

AK: No, no, you will have done it_ year, ah, year 9?

G: But that was easy on those computers!

AK: It's slightly different [AK chuckles and moves to the front of the room]. You need to go into your file page setup and have a wee look in there_ (tc 28/8/01)

Gini's experience is that learning how to use a word processing package with one computer does not mean that she automatically knows how to do the same on another machine.

Prior experiences mean that some students are more familiar with particular computer applications or practices and are able to draw on this knowledge in the classroom context. For instance, two students appear to be more comfortable and inclined to use the computer help menu when faced with problems in 12CPS – Mason and Scott. Scott is the only student I observed to use the help menu, although Mason talks of this as a common problem-solving strategy in his repertoire. He says that the problem-solving strategy he adopts “depends on the

problem really” (si 14/9/01) and that he would use help if he cannot open a program, has difficulty loading software or encounters formatting errors. Others may use the help option on occasion, but not as a first or a commonly utilised strategy. It is perhaps no coincidence that the two who use the help menus are those who have hobby interests in the technical aspects of computing. They appear to be comfortable trying to solve problems on their own – the help menu being a mechanism to achieve this – and welcome problems as a personal challenge.

Prior experience contributes to students’ feelings of confidence and self-efficacy. This is perhaps most obvious when students engage with software and perform tasks with which they are already familiar. A number of students attest to having prior experience using Word and to finding the word processing components of CPS and TIM courses the easiest. Even if the software itself is new to students, previous experience with computers can engender confidence in one’s ability to overcome problems. This is evident in 12CPS, where students present a range of interests and describe quite different forms of recreational and out-of-school computer uses. Scott, for example, appears to derive much of his self-belief and high rating of his computing ability from his hacking activity.

R: Why would you put yourself at seven [out of ten in ability ranking]?

S: There is heaps to learn still.

R: In what areas are you conscious that there is still heaps to learn?

S: Oh, in any area there is heaps to learn. Each year_ it gets up, computers get upgraded so new programs get added_ So you never get (smarter than the computer). There is always different programs and different_ versions coming out – different commands.

R: Yip. Are there any particular aspects of computing that you feel that, like you really do know pretty well?

S: Programming. (si 17/10/01)

Although he says there is “heaps to learn” Scott doesn’t doubt that he is able to master the technology. It is just that the pace of technological change creates a perpetual knowledge gap. He talks of all the work and computer applications in 12CPS being “quite easy” and boasts of his hacking ability.

R: What, what in particular is fun? What do you like doing_ with computers?

S: With, oh, with computers_ Getting personal information and so on.

Bn: You said that you were going to teach me that sometime.

R: You like doing that?

S: Yeah.

R: Do that a lot?

S: Yeah, I've been busted a couple of times.

R: A couple of times?

S: By the cops

R: Yeah. Still doing it?

S: Yeah. I've, stuff, I got a job with [company], part time_ to program it, systems programming.

R: When did you get that?

S: When I, when I asked them, well "I'm bored. Computers are easy." And they go "How about we keep you out of trouble_ give you a job." (si 17/10/01)

Scott also brags about accessing pornographic sites on the Internet, as well as personal information such as credit card numbers and PIN numbers. He seems to take pride in using his computing skill to subvert authority, or likes to think that he could do this, and seeks the admiration of others for his actions. Scott's illicit hacking experience contributes to his belief in his computing ability, particularly in relation to programming. Whether or not Scott has been as successful in hacking into personal information as he indicates, it is apparent that he is confident of his own ability, a confidence acquired outside of the 12CPS class but which has an impact on his experience in 12CPS.

In contrast, Lisa doesn't have a computer at home and accesses computers at school and at friends' houses. She says she uses computers regularly, but not necessarily every day, most commonly for schoolwork, to access information on the Internet and to play games. She expresses a strong preference for uses associated with document presentation. A recurrent theme in Lisa's description of her experience in 12CPS is lack of confidence in her knowledge and ability. This is despite the fact that, according to Mr Lucas, she is amongst the highest achievers in the class assessment rankings.

R: ...Can you describe for me two things? One is something really positive that has happened to you in this class and the second thing is something negative that has happened in your year at computer studies. Get something in your head, something positive, and something that you think is negative.

L: OK my something positive is apparently I am coming like third in class and the negative is I don't know *how* because I'm still_ like confused on a lot of the aspects, and I just keep forgetting stuff that I should know and yeah.

R: Any particular aspects?

L: Um. Coming across a test and not knowing what the hell to do.

R: Yeah. Any particular tests you are thinking of there?

L: No, I can't remember. (si 21/9/01)

She seems to be particularly frustrated by the idiosyncrasies of different software and daunted by applications she associates with mathematics, as revealed in the following excerpt.

R: ...Do you think you are good with computers? So if you picture a scale and like if one is not very good and ten is really good, where would you put yourself on there and why would you put yourself in that position?

L: Four.

R: Why Lisa?

L: Because I don't know much about computers because I don't have one and I get confused easily.

R: When you say you don't know much *about* computers do you mean about how they *work* or about the programs that you are using or the applications that you are using?

L: Ah, a bit of both_ actually. Oh I'm probably not that bad but_ I don't know, I seem to have my difficulties. That is why I took this, to learn more but_

...

R: Is, is, so is it a difficulty with the program or is it difficulty with the way the computer works or the way it organizes it's files or_?

L: Just adjusting to different programs.

...

R: ...are there any particular incidents that have made you think you are a six or a four? Like do you think any thing in particular has happened in this class and you think "Yeah, that's why I'm good at this or not good at that"?

L: Ah_ I'm good at the word processing because there is not much involved in it but I get confused with formulas in spreadsheets or databases or whatever it is, and programming. It's just lots of maths terms and formulas and I'm not very good at [maths]_ and I don't do it this year and I've forgotten everything. (si 21/9/01)

Lisa doesn't have previous experience of programming and her schooling experiences have taught her that she is not very good at mathematics. Thus she resists engaging with applications she associates with mathematical practices, such as programming.

Kathy is likewise less confident with the aspects of 12CPS with which she has little, if any, previous experience. She indicates that she mainly uses her home computer to go on the Internet and to type up stuff. She feels confident of her ability with word processing in 12CPS, which she considers to be easy and for which she has achieved her best assessment results. In contrast, she is far less positive about programming, which she thinks is difficult. It may be that the programming unit is cognitively more challenging. However, it appears that prior experience with different applications and practices plays a part in Kathy's preferences for different components of the 12CPS course. Her previous experience with word processing

contributes to her enjoyment and confidence with this aspect of the 12CPS course, the converse being the case in relation to the programming. She likes the applications she had experience and knowledge of before entry to 12CPS.

Winifred thinks she is good with computers, rating her ability as eight out of ten. She makes this assessment on the grounds that she has used a computer at home for many years, is comfortable using the applications taught in 12TIM and is able to assist others with some software features, such as demonstrating how to locate clip art images. She displays positive self-efficacy despite experiencing disappointment in her assessment results. She is reluctant to talk about her SC result for TIM in the previous year, this being a source of embarrassment. As she explains it, she was in the beginners group in her TIM class in year 11 at her previous school and consequently didn't do very well in the examination. She also expresses disappointment at not getting the mark she thought she deserved in her assignment on pop music this year in 12TIM, given the amount of effort she feels she put into the assignment, and surprise at doing well in an assignment into which she didn't put as much effort.

Winifred's self-belief in TIM derives in part from her experience in contexts outside of school. She makes positive comparisons between herself and her peers and family. She reports that many of her friends are afraid of computers, which sets Winifred above her peers. Also, she judges herself as more knowledgeable and skilled with computers than her father, which is proven by his seeking her assistance to perform tasks using the computer.

W: Um, um_ [I'm likely to use a computer] in jobs and all that, because my Dad asked me to do some stuff for his work.

R: What's his work?

W: Oh [company name]. He just asked me if I knew how to use databases and I'd go, oh, a little bit. Some things that I (learnt in TIMs really). Yeah, he just asked me to show_ Yeah even my Dad doesn't know how to use database.

R: So you help him_

W: Well I help him --- Yeah, kind of. Ah, but I am still learning so I wouldn't rely totally on me.
(si 29/8/01)

Winifred's previous and concurrent computer uses are consistent with the type of use made of computers in 12TIM. She is involved in a youth night school, which she thinks is "just like TIMs" (si 29/8/01). She says she mainly uses her home computer to word process school assignments, to use the Internet to find information, to muck around with PowerPoint and to

create cartoons. There is familiarity and comfort in the congruence between 12TIM and her prior experience, which appears to contribute to Winifred's positive attitudes towards the 12TIM course.

Students make varying use of computers outside of school. This appears to have a bearing on their experiences in specialist IT classes. The nature of previous experience and familiarity with different applications helps to define students' likes and dislikes, their ideas about how skilled they are in relation to computer use in general and in respect of competencies addressed in specialist IT courses.

Pedagogy

The way in which lessons are organised and learning is structured is a factor in students' experiences of specialist IT courses. The technocratic construction of CPS and TIM courses at KHS appears not to be at issue with students. None express dissatisfaction with the "how to" focus of the courses. Rather, students choose to take these subjects because they want to learn how to use different applications. Nor do students appear to be in any way concerned at a lack of formal, structured group or cooperative activities. They accept that in TIM or CPS they will work independently with computers. However, the way that the independent work is organised, such as the pacing of activities, is received differently by individuals.

Some students relish the opportunity to work independently and at their own pace through a sequence of activities for an extended period. These tend to be the higher achievers who are confident of their computing abilities and who enjoy the personal challenge of independent work – for example, Harriet in 10TIM and Joanna and Mason in 12CPS. Harriet talks of frustration at having to wait for assistance from the teacher when the instructions are unclear or particular procedures have not been explained at the beginning of the lesson. She feels that she is being held back and her preferred solution is for her and others to be supplied with reference sheets that will enable them to be more self-reliant.

H: So it would be kind of better if she gave out like a sheet of what we were doing and then just gave it to us. Like read it through as a class_ and if we had problems she came around, but (if it) had most of the information on it instead of_ Because she just stands up at the front of the class and tells us and_

V: You forget it half way through.

H: You forget. Like you remember the first bit of it but you forget like the rest of it and that's why it takes so long. It's probably why it's, stuff has taken so long to get like through spreadsheets. (si 2/11/01)

Mason appreciates and is comfortable with the way 12CPS is structured and presented.

R: I've noticed that the pattern in, in your class is largely that like you have got a work sheet and you work through that. Do you like that type of activity?

M: Oh, it's OK but_ like the way we've got it now is pretty much the easiest way. It just states what we have got to do and the rest we do ourselves_ which is_ helps you learn, more creative. (si 14/9/01)

For him learning is a matter of individual endeavour, which he construes as creative practice. Creativity means being able to perform tasks independently. His one concern about this self-teach approach relates to access to teacher time.

M: Oh_ Yeah. He [Mr Lucas] comes round helping, writes on the whiteboard, same sort of stuff [as mentioned by Carl]. Just need more of him really, coz we are always, everybody is always asking for his help, so_ there's more people to help out [that the teacher needs to help out]. (si 14/9/01)

However, Mason sees no reason to be critical of Mr Lucas's teaching approach or the structure of 12CPS lessons. He doesn't blame the teacher for this situation. Rather he indicates that the difficulty lies in the pressure of numbers and demands made on the teacher by other class members.

Joanna describes frustrations in working through the activity sheets, but like Mason she thinks this is an appropriate way to present and engage with computers in CPS.

J: ...We just get those sheets of paper that we have to work through. So they are all_ just_ activities but_ it's_ gets harder, harder as you go through, but it's pretty much the same sort of thing but it's like these activities is all we do, but the activities get harder.

R: Yeah_ And do you like that? Do you like that type of structure for the class through the lessons?

...

J: Yeah, well, it's not too bad but then like_ when it describes something it can only really do it brief because it's written down. But then you call Mr Lucas over and it's really confusing. It's like "Oh my god!" But you generally get it in the end, so that's all good. (si 30/10/01)

Joanna's ability to master the procedures "in the end" mitigates any negative experiences in the process. She accepts that confusion is integral to learning in 12CPS, to be worked through knowing that everything will come right. Although she thinks that the instructions may be

insufficient and teacher explanations confusing at times, these things don't translate into a negative view of the course or lead her to criticise the focus on individual learning.

In a contrary vein, Kathy has a more negative reaction to the way 12CPS lessons are organised. She claims that "he [Mr Lucas] just expects you to understand it while you are doing the work" (si 21/9/01) and signals that she would like more direct teaching, with the teacher providing more in the way of whole class instruction or explanation.

K: But rather than doing all these ex [exercises], you know, pages and pages of exercises the whole time. Just_ I thought it would be more teaching_ teaching on the board, type, go into this, you know, this means that. (si 21/9/01)

She wants the class to work at a more consistent pace, which she thinks would be achieved by having the work organised in smaller chunks.

K: ...I'd rather have a set worksheet for the week rather than just having a set of 20 questions on the different worksheets and having to get through that. So everyone has to go through at the same pace.

L: Yeah. So that way if you finished early you could do whatever and---

K: So you have got the things set for the whole week.

...

R: I had the impression that in some ways that is how these tasks sheets are working. Is that not the case?

K: Nup. They are just_

R: Like people are at different places on these ones [programming worksheets].

K: See I'm up to question_ 12 and some people like_ I don't know.

L: Mason is only up to like extension question 25 or something. [irony]

K: Yeah so I mean they are not done on_ weekly. They are just done_ get them finished when you finish. See I'd rather have_ you get, you know everyone gets the same sheet or book or whatever and they have got to finish that in the week. And so if you get it finished, you get it finished but_

R: So and then you would like everyone to come back just, I'm just trying to clarify this, and like start at the same point again at the beginning_?

K: Yeah. So that everyone is at the same point. Because he, Mr Lucas, works with those people that are way ahead and he never, you know_

L: So probably it would be a lot easier to teach if everyone was at the same point.

K: Yeah coz he could help everyone coz they would all be at the same_ doing the same thing rather than have some people doing (word pro) one, you know. Coz they, I don't know. I reckon it would be way better. (si 21/9/01)

Kathy feels she would get more help and be less inclined to fall behind if the 12CPS course was organised in a way that gave less emphasis to independent work and included more direct classroom teaching.

Another pedagogical factor that some students cite as an influence on experience is opportunities to engage with material from contexts of interest to them and that may have nothing to do with computers *per se*. This is evident with students in 12TIM. The girls in this class are focused on computers as information tools that can be used in a range of contexts or disciplines and welcome opportunities to undertake research. For example, Gini is inspired by the opportunity to find information about the Olympics in her research project relating to the use of a database.

R1: Gini? What are you doing ---?

G: Athletics ---_ Yeah_ [sound of shuffling] The sports one, yeah. I don't know.

...

G: Yeah, I'm doing the, um, produce a fact sheet on a sport of your choice.

R1?: Oh, cool. So what sport are you going to (be doing) ---

G: Pretty much, I think its more Olympics than athletics [shuffling continues]_ but yeah_ [sound of zip being done up]

...

G: These are the, some of the mascots.

R1: He's cool.

G: Oh, he's --- [paper shuffling] I can't remember that one. And then there's, ah, that one_ yeah_ Very different ones.

R1: They are so cool.

G: Ahh [sceptical]. They are actually quite (neat). I love them ---

R1: I know. You've spent ages on it.

G: I know. I even do it at home now. Yeah. I'm shocking_ (sc 13/6/01)

Emma is interested in fashion and is motivated by being given an opportunity to conduct research on 1960s fashion and by having freedom of choice about what to record and the style of language.

E: Oh no, I like the ones [class activities] where it was a research assignment and you had to, you picked a topic and I did 1960's fashion and, um_ you had to get all the information but you couldn't, you know, copy it straight from a book. You had to change the words and stuff. And I liked that the best because I got all my own information and could put it how I wanted it, you know because it was for young people to read. So, you know, it was easy because you could just

kind of write the way young people talk or whatever [chuckles]_ whatever. And um [chuckles], yeah I like that the best. (si 28/8/01)

Angela enjoys using the Internet to access material about the rock band Zed. Winifred is excited by the opportunity to interview people in the process of gathering data that she will input in her database.

In contrast, inquiry activities and opportunities to pursue interests outside of computing do not have the same prominence in 12CPS as a pedagogical strategy. Nor do students show similar levels of interest in such opportunities, at least they are not something that students choose to talk about when describing their positive and negative experiences of the course. Some of the students who are strongly interested in 12CPS and largely uncritical of the pedagogy employed, such as Mason and Scott, are interested in computer technology in and of itself. By engaging with computers in 12CPS they are also engaging in their hobby. The choice of topic or the context of tasks appears to be largely irrelevant for them.

Classroom relationships

The nature of classroom relationships plays a part in students' experiences, influencing their choices of IT subjects and their attitudes towards the courses.

The girls in 12TIM cite their relationship with the teacher, Mrs Keall, as a strong positive feature in their experience. The prospect of Mrs Keall as their teacher was a reason why several chose to take 12TIM. Both Beth and Winifred intend to take TIM next year and express a desire to have Mrs Keall as their teacher. In spontaneous comments they signal that their relationship with Mrs Keall is a significant component in their enjoyment and achievement in 12TIM.

W: I *love* TIMs, yes_ And I think_

R: Why?

W: I don't know. I know so much already about it, but still I know I have to learn more. And plus the teacher, yeah, Mrs Keall. She's cool. She makes a big difference.

R: And you're nodding Beth. I take it you like TIM as well?

B: Yeah. When I did it in third form I had a different teacher. .. So she made it like really friendly and stuff and I liked that. And then in fourth form we, I had Miss Keall, and I just absolutely loved

her. So it's_ It was also her. Not just because I liked typing but it was, I think it was mainly her because she made it so fun and she was so nice and_

...

R: [chuckles] Do you think the approach taken by your teacher is helpful and effective in helping you learn about computers?

W: Yip. --- Yip, but yes, mainly yes.

R: And, so that the yes because_?

W: Because I'm passing and Miss Keall is doing something right. Yeah um, no because she_ she has got this cool way of teaching yah? It's not, it's not_ the same as the rest of the teachers. She doesn't baby us but she also doesn't just neglect us, and just --- do our own work.

R: So what makes it different to the rest of the teachers?

B: It seems likes she actually cares. Like--- (that's how) you feel.

W: Yeah. Yeah, she does. She cares, eh. But she gives us room too, eh? She doesn't try_

B: She doesn't smother you and like_ watch you all the time but then she is always there, like, just watching.

W: And she, and by doing that she knows that we will finish the_ the, um, work (and aspects).

B: And she doesn't get like really angry. Like some teachers will just blow up at you if you do something wrong but she only does that if you are really mucking around and not doing anything.

W: Yeah, yeah that's another thing.

B: And that's after like a couple of periods. She won't, or she will talk to you quietly and ask if everything is OK.

R: So is that caring important to you?

W: Yes. Really. It is a big yes.

B: If she wasn't like that, I probably would not have carried it on. Because I mean_

W: I'd probably move to computer studies! [laughter]

B: Yeah. Coz like most of my teachers, like they care but they are not_ I don't know. There is just something about Mrs Keall.

W: A bond that she creates with us.

B: Yeah. Even like you have only known her this year.

W: Yeah.

B: But it's like you have known her your whole life. Like_ just_ yeah. Just something about her. Something about Miss Keall.

...

B: I want to be a flight attendant. But I really want to do that because, um, Mrs Keall has made me believe that I can do anything I want. Because like when I first came into this class I was really self-conscious but now it is just like I don't care what people think of me --- (si 29/8/01)

Beth attributes her heightened self-esteem to Mrs Keall. Winifred claims an interest in becoming a teacher of TIM, amongst other things, signalling that she would like to model herself on Mrs Keall. She also describes Mrs Keall as "motherly" (si 29/8/01), and indicates

that feeling cared for and nurtured by Mrs Keall is an important and positive part of her experience in 12TIM.

Others in 12TIM also speak of their relationship with Mrs Keall in positive terms. Angela describes this relationship as a friendship.

A: Very friendly. I don't think any of us see Mrs Keall as some big authority figure telling us what to do. We know she's the boss but she's, she still teaches in a way that's very friendly, it's very on our level so that makes it a lot easier as well when you are trying to learn stuff. A friend telling you what to do. (si 24/8/01)

Emma and Gini claim Mrs Keall as a reason for their participation in 12TIM and continued enjoyment of the course.

E (Emma): I think I picked typing this year cause I looked at computer studies, I think Mrs Nugent takes that, and I don't know Miss Nugent and I like Mrs, like Mrs Keall was nice to me last year so I just thought that I would take typing again [laughs]. That's because I like, like the teacher. Coz if I don't like the teacher in the class, I just don't like the class at all. (si 28/8/01)

And

E: I think, yeah I think she's [Mrs Keall] real good. She's um_ it's like you can tell she really enjoys working with computers. Yeah, because she, I don't know, she just gets excited about things that she shows us, you know. And like if she is going to show something new, you can tell that she is enjoying telling us and stuff – she's real enthusiastic. And she is not all, you know, she is not too strict either. She's hard[ly], she never really ever grumpy. But if she is, it is because someone's talking too much [Gini chuckles], you know. And she, you know, she'll just, she'll say be quiet but she still kind of smiles at you, which is pretty good.

R: What about you Gini?

G: I um, nah I think it's definitely fair and she's really_ I don't know, she is also easy to approach because some teachers are like, you know if you have got a problem, 'just come and talk to me', but we don't. Some people just don't. With Mrs Keall you can just stand there and yell her name out and she'll come, I mean which is quite cool. But nah, definitely. (si 28/8/01)

These students have an emotional connection with the teacher and feel safe in the 12TIM class, which disposes them to think well of the course and select it in preference to CPS. They have chosen 12TIM anticipating a particular type of teacher-student relationship, based on previous experience of TIM and previously formed relationships.

Relationships with peers are also a factor in students' enjoyment of 12TIM. For Winifred, a new arrival at KHS, the 12TIM class is a source of valued friendships.

R: What about this class – you know this group of people that you are with? Do you like your class?

W: My friends. Yes. My only friends in the school! [laughs] No. Yes I like them. They're cool.
 Ah, Gini. Gini, she's really funny, she's_ (si 29/8/01)

Although Winifred jokes that her only friends at KHS are in 12TIM, there is a feeling that this is indeed the class in which she feels most comfortable – more so, it is implied, than in other subjects. Other students also speak of the 12TIM class as “friendly” and comment that the students “get on” and help each other (si 24/8/01). I witnessed nothing I would construe as animosity between teacher and students, or students and students, in 12TIM.

Similarly, the classroom social climate influences students' experiences of 12CPS, but in different ways. Students acknowledge their relationships with their teacher, Mr Lucas, and with their peers as an affective factor in their classroom experiences. However, unlike in 12TIM, the teacher appears not to be a significant factor in students' selection or rejection of CPS as a current and future course option – at least he does not feature as a reason in students' responses when they are asked why they chose to take 12CPS. This is not to say that the identity of the teacher has no bearing on students' course selection in 12CPS, but that this is not as significant as other factors in their thinking.

All four of the boys and two of the girls, Xiao-hong and Joanna, speak positively of their relationships with Mr Lucas. They think he is interested and committed to helping them to learn and they respect his knowledge. They indicate that they find him approachable. Several comment that they enjoy engaging in verbal banter with Mr Lucas. For example:

R: How would you describe the way in which_ Mr Lucas teaches?

S: As Ben said, you can hassle him_ and he doesn't care.

R: And do you like doing that?

S: Yeah.

Bn: That, that's, that's just part of_

S: (If) you relax, in this class.

Bn: Yes. That's one. That, that's a part of relaxing. I mean, you go to class, (do) you hassle someone. That has to be, I mean even if it makes you get hassled, you know, it's just friendly hassling. Nothing_ you know, that's, that's choice. To be able to do that with someone it's choice. It's sort of_ I don't, I don't know, it's just sort of instead of_ it's him being up here and you are down there, it's sort of, you know, it's more_ more even.

R: Yeah.

Bn: I mean he has still my authority [respect]_ sort of, yeah. (si 17/10/01)

And

J: Well I've never had him [Mr Lucas] in, as a teacher before, but he's just really laid back and like talks one-on-one with the students and stuff. And I've got a few teachers like that and I find it's really good.

...

J: And how we can dis [ridicule] each other.

...

R: ...are there any particular incidents that you can think of that would help elaborate on that fact, you know Mr Lucas has done particular things you like, his style? Any particular stuff that has happened where you think, yeah that was really good. I really liked that?

J: Um, I don't know, it's just when we are doing stuff and we have a question whatever, or whatever, and then it just goes like into verbal abuse and stuff. That's really funny. And, you know, me and Ben would try to take him down and he always beats us_ Except for like once or twice. (si 30/10/01)

Joanna describes a competitive and rumbustious classroom climate. Verbal sparring with the teacher and their peers is a source of enjoyment for these students. It contributes to positive feelings about 12CPS. However, not all students respond positively to this teacher-student banter. Kathy in particular appears to resent caustic comments, even though she initiates and engages in such banter and uses sarcasm to challenge Mr Lucas. Her sarcasm appears to be a defence mechanism born of feelings of inadequacy and injustice.

There is a social schism in the 12CPS class on ethnic lines. The international students are all from East Asia and keep largely to themselves, as do the New Zealand students. This division emerges as a source of tension with some of the New Zealand students, who accuse the international students of dominating teacher time. Students are asked in interviews to comment generally on how the students in the class get on together, but they are not asked to make any comparisons between ethnic groups. The following are spontaneous comments that reveal antipathy and bigotry in students' thinking about the class composition and teacher-student interactions.

S: Heaps of people are slow. Mr Lucas is always over there talking to them_ Especially like international students. They are not going to be here_ and he spends most of his time over there instead of helping the people who are going to be here for the whole year and are going to sit the exams.

R: (What about you) Ben?

Bn: That's true. Yip_ No, I, there, there, there are some people that are_ are OK but yeah it's_ it, it gets a bit annoying and frustrating when you have got_ people like that.

...

Bn: You put your hand up and you wait_ you wait say 15 to 20 minutes until_ Mr Lucas finishes helping out the foreign students_ and then hopefully_ um, he knows what to do. (si 17/10/01)

Interestingly, Scott is not a candidate for SFC, but he distances himself from the international students who like him may not undertake national assessments this year. Ben's talk of "people like that" is pejorative.

Kathy and Lisa make similar observations and criticisms.

K: Yeah. Yeah. Coz I find I'm always_ coz the reason why I am behind is, you know, you have got your hand up for like half the period and he's busy talking to the exchange students. He is *always* with them, so I mean you get_ bugger all_ yeah. (si 21/9/01)

And in a classroom conversation:

L: No. Just put OI-U-NO. Yeah [giggles]_ Oh, how rude. He [Mr Lucas] went to the Asians first.

K: He's closer ---

L: They pay more_ [general laughter]

K: Ohh! Ha-aaa! (sc 28/8/01)

Regardless of whether Lisa's sharp jest and suggestion of favouritism is justified, it is apparent that some students feel that an inordinate amount of teacher time is spent with the international students and that this is a source of resentment and tension in classroom relationships. It is a negative feature of some students' experiences of 12CPS.

In 10TIM a source of frustration or discomfort for some students is the behaviour of groups or individuals, particularly boys, who are inattentive and fool around in class, distracting others and commanding teacher time. For example:

Sn: Yeah. She [Mrs Nugent] tends to like_ try and work harder with the guys.

[Interruption with a visitor to the room]

R: Sorry. So you were saying_ I asked you do you think boys and girls are treated differently in this class.

Sn: Yeah coz, yeah coz like Mrs Nugent always has to go like to Tom, like Rawiri, and work hard with them, and Brent, because they don't listen. They don't want to do anything. (si 21/11/01)

This may take the edge off their enjoyment of the class, but it isn't something that students tend to focus on when talking about their positive and negative experiences of the course.

They seem to be used to such behaviour and largely ignore it, operating as they do in small peer groups within the class.

Students' interpersonal relationships and the social dynamics of the classroom are a part of their experiences of specialist IT courses. For some students, their relationship with their teacher is an important factor influencing their attitudes towards the subject. This is particularly evident in 12TIM, where several girls speak of their relationship with Mrs Keall as a key factor influencing their enjoyment of the course and subject selection. The classes observed have different social environments and classroom cultures. For instance, the relationships and class dynamic witnessed in 12CPS appears to be more overtly competitive and rumbustious than in 12TIM. This is not to say that competition isn't a feature of the 12TIM classroom, but that it has a softer edge. Students interpret events and interactions in the classroom differently, depending how much they feel a part of particular social groups and how closely they relate to the teacher and their peers.

Performance

Students' attitudes towards CPS and TIM courses are influenced by the results that are achieved for assessments and perceptions of their performance. For example, Gini makes a negative comparison between her results in 12TIM compared with her peers and she is less enthusiastic about the course than are others in the class. Kathy labels herself as a "dumb arse" in 12CPS and places a negative construction on her experience of the course. At the other end of the scale, Mason is achieving well in 12CPS and he consequently has a favourable view of 12CPS. This is in marked contrast with his experience of English, where he thinks he is achieving poor results – "I hate English. It doesn't agree with me much" (si 14/9/01).

However, students' performance in specialist IT courses does not determine that they will construe their experiences of particular subjects in positive or negative terms, poor results meaning a negative experience and good results a positive experience. Rawiri thinks he is failing in 10TIM and that it is not a subject for him, but he struggles to identify negative experiences of the course and class. In contrast, Lisa is critical of 12CPS even though she is achieving good results for tests. Winifred describes a disappointing performance in

assessments for 12TIM but she is effusive in her liking for the course – “I just absolutely love it” (si 29/8/01).

Thus, performance is a factor that helps to define students’ experiences of specialist IT courses. However, it is one of a range of factors and it may or may not have a strong influence on the meaning students make of their experience in CPS and TIM classes. The ameliorating influence of other factors, including expectations, prior experience, pedagogical practices and classroom relationships, means that there are disjunctions between students’ assessment of their performance and the construction they place on their experiences of specialist IT courses.

Summary

Students’ experiences of specialist IT courses at KHS vary greatly and are influenced by a range of factors. Each has his or her particular patterns of use, interests in computers, expectations, likes and dislikes. They interact in different social groups, bring different prior computing knowledge to the class and may have quite different motivations for taking a course and therefore quite different expectations. The meanings they make, their reactions to the way a course is presented and their ideas about its efficacy or value differ. What one person construes as a negative feature in his or her experience may be a positive factor for someone else. However, some common factors emerge from the observation and interview data that help to define students’ experiences in TIM and CPS courses. They are the degree of congruence between students’ expectations and the reality of course content, prior experience with computers, the pedagogy of the classroom, classroom relationships, and students’ perceptions of their performance.

One or more factors may be more prominent in the talk and meaning making of students in different subjects. For instance, the congruence factor appears to be a stronger influence in students’ enjoyment and judgements of the worth of 12CPS than it is for students of 12TIM. This is because there is a greater discrepancy between expectation and reality in 12CPS. Such a discrepancy appears not to exist for students in 12TIM and therefore doesn’t feature in their descriptions of their experiences of the subject. Classroom relationships, especially student-teacher relations, feature in the talk of 12TIM students. This does not mean that such

relationships are insignificant features of students' experiences in other classes, but that the 12TIM girls are more conscious of the importance of this as a defining factor in their experience of TIM.

Tensions evident in the discourses of IT described by teachers (see Chapter 5) are also apparent in descriptions given by students of their experiences in specialist IT classes. Teachers and students share in and promote computer-as-tool, technocratic “how to”, and utilitarian constructions of CPS and TIM subjects. These notions of what school computing should be, and which broadly define the curriculum in practice at KHS, are what attract students to both CPS and TIM. Nevertheless, there are differences in students' notions of what a particular subject should be about, and therefore what being a student in a particular specialist IT course entails in terms of learning and engagement with computers. These tensions are reflected in the meaning students make of their experiences of CPS and TIM courses. For example, Ben is dissatisfied with 12CPS because he expected it to be more about how computers work and he subscribes to the CPS as IT/information systems discourse. He is dissatisfied with the emphasis given to general applications and the basic skills construction of CPS. In contrast, Kathy is dissatisfied with 12CPS because she subscribes to an office practice discourse and she dislikes the emphasis given to programming in 12CPS. A tension between the discourses of CPS as basic skills and CPS as IT/information systems inherent in the form and structure of the curriculum in practice for 12CPS is played out in the way that students experience the course. Describing and accounting for students' experiences of specialist IT courses at KHS is problematic. At one level students' experiences can be seen as a matter of individual preferences for different types of computer applications and ways of engaging with computers. At another level their experiences can be seen as part of the broader phenomenon of the social construction of computing, which is reflected in competing discourses and played out in a school setting.

There is nothing essential about gender as observed in the experiences of students at KHS. For example, girls do not necessarily dislike independent learning in specialist IT classes, although some might prefer a different approach. Joanna, for instance, enjoys the competitive environment and likes engaging in independent activity in 12CPS, whereas Kathy criticises the organisation of the units of work and the requirement for self-paced learning. Males do not

necessarily reject a utilitarian construction of IT and emphasis on document production, as witnessed by the appreciation of boys in 10TIM for skills they can transfer to other learning situations. Likewise, females do not necessarily value document construction and presentation above other forms of computer activity. Joanna and Xiao-hong, for example, especially value 12CPS for its programming component. Nevertheless, there is a discernable gendered character to students' experiences at KHS. This is discussed in the following chapter.

Chapter 7 **Case studies: students' experience, gender and curriculum culture**

What part does gender play in students' experiences of specialist IT subjects?

It could be argued that gender is a fundamental social relation and feature of human existence, and thus it is a part of all human experience (Biklen and Pollard, 1993; Connell, 2002b; Fenstermaker & West, 2002; Kimmel, 2000; Knuttila, 1996). It is therefore a truism to argue that gender plays a part in students' experiences of specialist IT subjects at KHS. More pertinent and informative is an investigation of how gender and gender relations play a part in those experiences.

When asking what part gender plays in students' experiences of specialist IT subjects at KHS, one is asking how being male or female, and notions of what comprises masculinity and femininity, affect what happens in the classroom and the meaning that students make of their engagement in IT courses. This is connected to students' personal identities as gendered selves and the subject cultures and classroom cultures of their experience. What personal gender identities do students hold as computer users? Do they perceive differences in males' and females' computer interests, roles or abilities? Do students associate particular subjects with male or female interests and thereby imbue them with gendered identities? What relations of power, authority or expertise are created in the classroom and are these gendered? Is there a different climate in classes that have different gender participation patterns, in mixed or single-sex classes? Affirmative answers to these questions would suggest that gender is a notable factor in students' experiences of specialist IT subjects. This chapter, then, focuses on matters relating to gender and personal identity, gender relations and subject culture, and gender relations and classroom culture in order to elucidate how gender and gender relations play a part in students' experiences of CPS and TIM at KHS.

Developing personal gender identities

To make sense of the way in which students construct gender identities as computer users I draw on the concept of possible selves. These are ideas that are held by people about who they are, who they might become, and who they want to be (see Chapter 1). Students develop their concepts of possible selves in the context of families and peer groups, in home, school and other settings (Markus & Nurius, 1986). In negotiating their possible selves, students construct their personal gender identities (Curry et al., 1994). They also take agency as they favour and resist different possibilities for their roles in life. Agency is commonly thought of as the capacity of individuals to influence and control their own lives and experiences. In this sense it is a personal condition. However, individuals do not exist in cultural, historical and institutional isolation. A socio-cultural view of agency has it that the choices and actions of individuals are socially mediated (Wertsch, Tulviste & Hagstom, 1993). Student agency, experience, social group membership and (gender) identity formation are thus integrally linked (Jackson, 2003; Serpell, 1993; Wertsch et al., 1993).

The socio-cultural literature suggests that masculinity and femininity are defined partly through the type of technological competence and skill that is sought and acquired by males and females (Jenson et al., 2003; Schofield 1995; Wajcman, 1991). Personal gender identities are created as individual students in specialist IT classes at KHS negotiate what it means to be a male or female student of IT and a computer user. There is variation in these personal gender constructions, which represent multiple femininities and masculinities. However, personal negotiations of gender identity are constrained by socially defined ideas of what comprises acceptable masculine and feminine computer practices; what could be seen as the influence of hegemonic masculinity and emphasised femininity (Connell, 2002a, 2002b). Notions of self as computer users are personally defined, but they are socially mediated. It is evident from the talk of students that girls tend to identify themselves as CPS girls or as TIM girls. They appear to have the social freedom to participate in both CPS and TIM courses. In contrast, boys are happy to be identified with TIM in the younger years, but those who pursue specialist IT subjects in the older years tend to resist associations with TIM and to develop identities as CPS boys. There appear to be social constraints on their participation in TIM courses.

Joanna provides an example of a girl who is negotiating a unique identity as an academic student and a CPS girl. She resists suggestions that she might have taken TIM instead of CPS.

R (Researcher): Why [choose] this class and not 12TIM, which also works with computers? Twelve Text and Information Management.

J (Joanna): Oh. Coz that's just pretty much just typing and I had done that_ in third form_ once, and, yeah, it was yeah, pretty much just typing. Like my friends do it and I thought "OK no." Coz they like send emails [incredulous tone], and it's like mmm this is more_ computers and how they work and_ stuff. (si 30/10/01)

She is disparaging of TIM and resists the notion that it would be an appropriate subject for her. She rejects being associated with the female tradition of office practice and aligns her interests more closely with CPS than with TIM, even though the utilitarian functions of both CPS and TIM might be seen to serve her career aspirations as a business person. Her concept of self is oriented towards that which she sees as more serious or academic computer studies.

R: So is there any particular parts of this course that you think it has that_ what you wanted that TIM doesn't?

J: Mmm. I don't know exactly what_ typing does, but I think this [12CPS] goes in deeper so_ can't really say. (si 30/10/01)

She shares with others – Mr Lucas, Mrs Nugent and a number of her peers – the idea that CPS is harder than TIM and is for students who are more committed to learning about computers, rather than for those who dabble in computing and are interested primarily in applications associated with office practice. Joanna is negotiating a possible self as an academic girl with professional prospects. Hers is a particular femininity, a femininity defined in part by academic endeavour and in resistance to traditional female roles. She resists associating herself with TIM, a subject she associates with keyboarding/typing. She perceives CPS as the more intellectual or academically oriented of the specialist IT subjects, and therefore as the subject for her. Xiao-hong likewise has academic aspirations. She expects to go to university on completion of her schooling and has a vision of herself working extensively with computers in the future, possibly as a programmer. She is happy with her subject choice and puts a positive construction on her experience in 12CPS. Joanna and Xiao-hong identify as CPS girls.

In contrast, Angela in 12TIM also sees herself as an academic student but she identifies as a TIM girl. In negotiating her identity as a computer user she connects with the utilitarian

construction of TIM. She sees value in having traditional female skills, such as keyboarding/typing speed and accuracy. These are consistent with her journalistic career aspirations. In a sense she is both resisting and conforming to a gender stereotype. She doesn't aspire to a career in a traditional office support role, but she identifies more closely as a TIM student than as a potential student of CPS. Angela's conformity is a rational, conscious decision to do what she thinks will set her up best for a successful career and support her particular academic endeavours. She perceives a need for particular types of computer knowledge and skills, focused on document production, which she is actively pursuing. Beth, Winifred and Gini also identify as TIM girls. These girls' experiences of TIM in year 12, and in previous years, have lead them to believe that the subject will provide them with skills that they will need and use in their future roles as travel agents, businesswomen, teachers, journalists and office workers. These girls don't necessarily expect to work in an office, but nor do they reject the skills of office work as inconsistent with their identities as computer users and students of computing.

Also in contrast with Joanna, Kathy's view of her future does not involve a need for programming or academic computing. She anticipates a "hands-on" career in the hospitality industry. She rejects the programming aspect of 12CPS, mainly because she sees this as a waste of time. Consequently Kathy is disappointed with 12CPS and implies that 12TIM would have been a better option for her. She does not see herself as a CPS student. Her gendered self is a non-academic, practical girl. She anticipates a future as a sometimes user of computers, who needs basic skills and knowledge that will enable her to produce documents and to use the Internet and e-mail for communication purposes.

Younger students are also negotiating their gender identities as computer users, which manifests in different stances taken on the applicability of TIM in their lives. For example, Vicky is negotiating her identity as an academic female. This is a reason for the relegation of TIM in her subject choices for year 11 to the position of a subject she will take if she has met more pressing academic needs and has room in her timetable. In comparison, Susan's possible selves include the potential for secretarial work. She has academic aspirations, but allows the possibility of work in traditional, female dominated office support roles. This leads her to identify TIM as a subject for her.

R: ...Why when you were making your subject choices did you choose to take TIM_ this year?

Sn (Susan): I thought it would help me in the future because I want to do something to do with computers. Maybe not computers but_ typing out things, maybe a secretary, I don't know. Coz I think that everyone needs to have computer skills and that's why I'm taking it next year. I'm *definitely* taking it next year no matter what. (si 21/11/01)

These girls are negotiating different feminine identities, which are defined in part by the technological competencies and work roles to which they aspire. This leads them to identify as TIM girls – or not, as the case may be.

Boys' images of self do not include being secretaries. They reject possibilities of self in traditional female roles that involve keyboarding/typing. Consequently they avoid 12TIM, which is the course that they associate with these practices. At the year 12 level, boys' gender identities appear to be inconsistent with TIM. Those who aspire to be technicians and programmers choose CPS, such as Mason and Carl, as do boys whose career aspirations are outside of the IT industry, including Scott and Ben. The process of gender identity formation can be seen in operation in 10TIM, where Matthew is learning that it is not cool for him to be interested in word processing and document production functions. Possible selves associated with traditional female computer practices are rejected in favour of those that are more acceptable in the construction of masculine identities.

This is not to say that individual males' concepts of self are necessarily incompatible with what is seen as traditional female computer work, but none of the embedded cases at KHS display interest in such work. Nor does it mean that males do not value general skills and knowledge of common applications, such as word processing. In fact, the boys in 10TIM and 12CPS feel that knowledge of word processing and other applications has utility value and is applicable in their daily lives. Rather, males emphasise other skills and practices in the creation of their unique and personal masculine identities as computer users, such as Internet use, programming, gaming, and management of computer systems. These practices are more closely connected with masculine symbols of power, authority, control and technological prowess. For example, Scott's masculinity is tied up with his hacker activity. He brags about his real or imagined hacking achievements. He reveals a competitive and aggressive masculinity in his passion for hacking and for violent games. Particular types of games, specifically role playing and flight or fantasy games that involve conquest and violence, are

viewed as a masculine domain by several boys, including Ben. Ben is a bit of a lad, popular with his peers and keen on sport. The competitiveness and aggression he describes in his gaming activity fits with his laddish masculine identity. Mason is also interested in games, but his personal masculine identity is more that of a computer nerd than of one of the lads. Computers play a central part in his daily life and he displays technological prowess in his game-playing and computer-building activities. The behaviour of these two boys in class reinforces their different masculine identities, one as a lad and the other as a nerd. Ben, the lad, fools around on occasion in class. He listens to music and talks with the girls and boys around him about weekend parties and sport. Mason, the nerd, stays focused on the computing activities at hand and restricts his social interactions to a small group of boys who share his computer interests.

As gender groups, male and female students tend to aspire to different types of technological competence and computer related work and careers. Girls' notions of possible selves encompass 'soft' secretarial and business related computer work and 'hard' careers as programmers. There are some traditional computer fields and roles, though, in which the girls show little or no interest, such as electronics and work as computer technicians. In contrast, the boys who see themselves working in some sort of specialised computer related employment aspire to occupations at the 'hard' end of the spectrum, including careers as computer programmers and technicians. Whilst individual students have different personal career aspirations, they appear to operate within socially defined boundaries of what comprises male and female work and computer domains, albeit permeable boundaries and overlapping domains. Masculinity and femininity are defined according to a spectrum or continuum of computer practices, which range from 'hard' (masculine) technical and control activities associated with electronics, computer engineering and computer science at one end, to user activities associated with 'soft' (feminine) clerical and office practices, including keyboarding, at the other end. The middle ground comprises a range of computer applications and activities that are associated with document production, information processing and communication functions. This middle ground is the domain of both males and females. There is contestation of the boundaries as students negotiate their gendered identities. For example, some girls are acting to appropriate programming as a legitimate activity for their female

selves. However, the extremes of the continuum remain socially entrenched as gender domains.

In the context of the computer-as-tool paradigm that operates at KHS, males display more restricted notions of what is acceptable masculine computing activity compared with females, which is manifested most clearly in their avoidance of TIM in year 12. However, it needs to be remembered that the curriculum at KHS and the subject choices available to students in 2001 are at the 'soft' end of the computing spectrum. Males' concepts of self in relation to roles as IT students and computer users may be only apparently more restricted. One can speculate that if the curriculum at KHS emphasized nominally masculine IT practices, such as hardware and software engineering, that the picture would be different. It is not appropriate, then, to generalise and claim that males or females at KHS have more or less restricted notions of possible selves as IT students and computer users. It is clear, however, that different types of computer practices are consistent with males' and females' concepts of their gendered selves, and others are anathema to them.

Gender relations and subject culture

The way that students talk about different IT subjects and courses reveals a gendered discourse relating to subject culture. In this context, discourse refers to shared values or understandings about what different IT courses are and should be about, and whose interests they do and should serve. Subject cultures are defined by the values, traditions and expectations that have grown up around particular subjects (Goodson & Mangan, 1995), and in the hidden curriculum of taken-for-granted practices and beliefs that initiate students into particular roles and relationships, including gender roles (Bryson & de Castell, 1998; Jones, 1988). Subject culture is represented in subject identities or subjectivities. By looking at the identities that students ascribe to different subjects, one gets a feeling for the cultures of those subjects. One also gets a feeling for the changeability of subject culture and identity, as different subjects undergo constant redefinition in the context of time and place.

Given the gendered participation patterns in CPS and TIM courses at KHS it might be assumed that students think CPS and TIM serve gender interests. But is this the case?

Students' talk about subjects and their reasons for taking particular courses at KHS reveals that they view CPS as a subject for males and TIM as a subject for females. However, this is a somewhat simplistic representation. Year 12 CPS is not perceived by students to be an exclusively male domain. Year 10 TIM is seen as a legitimate subject for boys, although males spurn 12TIM. The situation, then, is more subtle and complex than it may appear at first glance.

Subjects for boys and girls

CPS as a boys' subject

Students associate CPS with IT industry/information systems and computer science models of computer practice. They think CPS relates to learning how computers work, even though individuals may be unclear what they mean by this or have difficulty articulating their thoughts. Learning how computers work, including technical aspects of their operation, is a motivation for students' participation in 12CPS. The IT/information systems construction appeals particularly to males and underlies their preference for CPS. For example, Ben chose 12CPS expecting that it would teach him about computer hardware and systems, even though he anticipates a career in business. Mason and Carl have similar motivations for choosing to take 12CPS.

R: ...Why did you choose to take this particular class? Why 12 computer studies? Why not let's say 12 TIM which also works with computer studies?

C: Oh I was expecting computer studies here was like hardware. Yeah because I would like to be a technician.

R: OK. Mason?

M (Mason): I just really like computers. I want to know more about them. (si 14/9/01)

Both anticipate careers as computer experts, Carl as a technician and Mason as a programmer.

Conversely, the association of 12CPS with computing hardware and operating systems is a reason for students, notably females, not to take the course.

W (Winifred): There, there is differences between computer studies and TIMs --- I [don't] know what, specifically what the difference is but, um_ I think that it, in computer studies you don't go into detail with_ I don't know, into great depths or like say word processing or something. Yeah. That is why I chose TIMs because_ computer studies. It's different I reckon, is_ Is it?

B (Beth): I think it's like mainly just the computer_

...

W: I wouldn't enjoy the_ computer studies class. They will be mainly_ like concentrating on the computer within, oh well I don't really know what computer studies is all about but_ ...

B: ...I think in computer studies it's more based around the computer working and stuff like, I don't know, maybe the insides of a computer or like loading things on and stuff. But I don't know. I'd probably get more confused. So I really don't need that! [chuckling] (si 29/8/01)

It would be wrong to think that the IT industry/computing construction of CPS appeals only to boys. Joanna chose 12CPS thinking that it would teach her how computers operate.

R: ...When you were choosing your subjects for this year, why did you choose to take this particular class? Why 12 computer studies?

J: Because my parents told me too. No [laughs]. Um_ Because I picked all my other subjects, pretty much, for the direction I want to take and I had a lot of trouble with my subjects this year with courses being cancelled and clashing and stuff but I saw this one and it was quite good and_ like, just thought that it would be important, um, yeah, good to learn how they work. (si 30/10/01)

She and Xiao-hong are attracted to the programming aspect of CPS. Aspects of 'hard' computing appeal to them.

It could be argued that the IT/information systems construction of CPS is a misapprehension, given the broad nature of the 12CPS course at KHS and its emphasis on developing familiarity with a range of common, everyday applications. Nevertheless, the idea that CPS involves learning about technical matters persists in the minds of students, as evidenced in the above comments by 12CPS and 12TIM students. Computer studies is thus associated with computer science and engineering traditions or disciplines. The inclusion of a programming unit in 12CPS ensures this association in the minds of the students. Students tend to think of CPS as a discipline, which has a defined knowledge base that includes learning about programming and how computers work, however confused they are about what the latter component involves. The disillusionment and regret of some students that the course doesn't address the technical aspects of computing in more depth is an indication of the potency of the idea that CPS is about computers, as opposed to being about using computer applications.

Computer science and engineering are academic disciplines and fields of work that have long been thought of as masculine domains (see Chapter 2). Through its association with these domains, 12CPS is subtly ascribed a masculine identity in the minds of students. It is

associated with masculine interests, which include computing practices such programming and systems design and management. However, the actions of students in their subject selections show that they do not see 12CPS as an exclusive male domain. Rather, they see it as a subject primarily for students (male or female) who have an interest in what have traditionally been masculine computer practices. The students' construction of CPS as a subject for students with masculine interests echoes that of the teachers of CPS and TIM at KHS (see Chapter 5).

TIM as a girls' subject

Students associate TIM with feminine roles and computer practices. The notion that TIM is a subject for girls is especially strong at year 12, where only girls are engaged in the 12TIM course. This is not to say that girls all have the same interest in TIM or favour the same computer practices, or that boys are uninterested in the applications utilised in TIM. Nevertheless, student talk reveals that males and females associate TIM with female work and interests, particularly with keyboarding/typing activity.

Students make a strong association between TIM and typing, based on their experiences of TIM over the years and what they have heard about the subject. This is despite the fact that few students anticipate careers as secretaries or in office support work. None of the six girls interviewed in 12TIM aspire to traditional office practice roles. All have taken 12TIM as a general purpose, utilitarian course. Regardless, a number of students in all three of the case study classes refer to TIM as typing, without prompting from me. I consciously avoid using the "typing" label, yet this is the term many students use when talking about TIM and it is the practice or activity that distinguishes TIM from CPS. Students use the word typing to mean both keyboarding practice and the subject of their previous and current experience. For example, Fiona chose 12TIM in part for its keyboarding component.

F (Fiona): I didn't actually think of doing computer studies, so I just coz, yeah, from year 9 I have just gone through doing TIM, so I just carried on from that one. And also I want, you know, um, when I leave school to in to [sic] the business (and things). So I thought TIM might help me with like typing and knowing how to use Word, coz that's used quite widely, and yeah_ (si 24/8/01)

Gini refers to the subject TIM as typing and she closely identifies the subject with keyboarding/typing practice.

G (Gini): ...then I got my grade and it was like real_ crap cause and it made me think, you know, what, what is the point in trying in typing...

...

G: Because, um, well like we said to start off with you always are going to need typing somewhere along the line. (si 28/8/01)

As does Beth:

R: So what is the difference between it [TIM in year 12 compared with CPS]? Like you said last year you were good at it_

B: Like typing. The whole typing thing. It's just_ I don't know.

...

B: Um, I did this class [12TIM] because, because Mrs Keall was going to do it and also because, um, I like typing ...

...

B: Like in typing it's like actually figuring out how to work the stuff [menus]... (si 29/8/01)

Although Beth indicates that she has been told that 12TIM and 12CPS are very similar in content she makes a distinction between the two classes based on whether they do or do not constitute keyboarding/typing practice. She favours the typing construction of IT, hence her selection of 12TIM as one of her subjects.

Students in 10TIM likewise think of TIM as typing. For example:

R: And what about the way in which the types of activities and the way in which you learn about computers? What style or types of things do you get to do?

Mw (Matthew): Just typing.

N (Nicholas): Yeah typing. Typing, typing and more typing. (si 26/10/01)

Vicky and Harriet appreciate the keyboarding/typing component of 10TIM, but with different degrees of enthusiasm.

R: So why were you choosing to take it next year? You know, assuming that that's the number of subjects you can take.

V (Vicky): Um, Well sort of like the main reason because you need it like for the future, like typing. Most things involve that. And also there wasn't really anything else I was interested in doing. So_

R: What about you Harriet? You said no.

H (Harriet): Um_ Because I thought I had already learnt enough. Like next year they said, coz I asked them at the interview things they said it's just basically going to be what we have done this year and I thought because I got quite bored this year with lots of things because we did so much of it, and if it is going to be the same thing next year then I just wouldn't want to go to typing_ and

also I know, I think, enough to do with computers and I don't think I am going to have like a job that is fully just going to be computers. (si 2/11/01)

Boys and girls in 12CPS also associate 12TIM with the subject called typing. Kathy and Lisa, for example:

K (Kathy): Oh we haven't used it [the internet] yet. So this [CPS] is just like typing, you know like TIM. This is just what that seems like. It's just_

...

L (Lisa): I don't reckon it's [like] typing. I've been in a few typing classes in, um, study and they get to do cool formatting and they do drawing stuff and they do projects and it looks more fun than what we do. (si 21/9/01)

By associating TIM with typing, students are making a connection between TIM and a traditional female subject or discipline, and with traditional female computer uses and secretarial practices.

Some students make a direct connection between TIM and secretarial work. For example, Emma in 12TIM:

R: ...What ones of these topics or applications do you actually think are the most useful? There may be a difference between what you actually like, but what you think is useful.

G: The letter writing is definitely the useful one.

E (Emma): If you are going to be a secretary or something.

G: Yeah. But I just think generally just knowledge of the computer, you know.

E: Probably, nah probably being able to touch type_ real good is what, you know. Because you don't, when you are a secretary or whatever you kind of get given stuff you know, that you just have to copy out and make it, you know, look all right and type it out and they usually want it fast so.

G: Like Shortland Street [TV programme].

...

E: Yeah probably being able to type fast and_ yeah, knowing where all your stuff [menu commands] is. (si 28/8/01)

These girls perceive the activities undertaken in 12TIM as pertinent background and skills for office work. Students in TIM classes associate the subject with office practice, even though they may not envisage themselves pursuing office work or careers as secretaries.

The image and content of TIM courses at KHS is changing as the scope of the course is broadened to include a wider range of applications. Winifred comments that 12TIM has "new

stuff” (si 29/8/01) compared with previous levels, which is different and challenging. In doing so she recognises a move away from a typing model. Students enjoy the design aspect of 12TIM. Winifred, for example:

W: Oh [I liked] that assignment that, the pop music thing that we did.

B: (That was) designing.

W: Yeah, yeah I like that. I like_ design.

R: Did you like it because of the design or did you like it because of the topic – like pop music?

W: Yeah I liked it because of the pop music but I also liked it because_ coz of the design. Yeah, coz I’m really creative. So, um, I just like it.

R: What did you have to do in that assignment?

W: You had to, ah, design a newsletter appropriate for a teenage audience. Yeah. Ah_ yip. We had ---

R: You had to?

W: Guidelines that you had to follow. But other than that it was up to us how we wanted to lay it out. Sort of. (si 29/8/01)

And Emma and Gini:

E: Um, I like the designing part of it. Like, oh probably drawing is quite cool. It’s still basic though, and um, it’s a bit boring I suppose. But um yeah, designing newsletters and stuff like that, I like. But I don’t really like, oh, I like writing letters as well, yip. Like, you know you get set with a_ scenario and we have to like write to some boss that you (like) want the job or whatever. I like doing stuff like that; making up stuff. But I don’t really like_ [long pause] oh, --- [laughter]

G: Um, oh well, the Internet and email would have to be my favourite but more to the work side I would probably have to say when she likes gives us some work to do and we have to design it, like for example newsletters and stuff. I mean I quite like the creativity side of it all, you know. Which is, that’s quite cool, and she just gives you so much work and you have to either, you know, edit it and stuff and then sort out how you want it done with borders, pictures, you know.

R: So what do you like about that stuff?

G: I think it is just being creative, and you know, I mean pretty much you are just doing what you want. Like you don’t have to_ put something, you know, something here and have this heading and, you know. You can just totally let your mind run wild.

...

G: The um, we had this music_ kind of test thing to do, and it was like, we got so much information and we had to set it out on four pages, for like a newsletter and I think that was, I enjoyed that a lot because you can just put colour where you wanted to and just, you know just totally set it out the way you want it which is quite cool. (si 28/8/01)

The notion of TIM as design might be expected to break down gender stereotypes of TIM as female practice. However, the design activities discussed by students relate to text production, such as the creation of letters and newsletters, as opposed to graphic design. Thus the students

experience design as a component of text production, which maintains rather than challenges the association of TIM with female practice.

There are some apparently contradictory notions in students' talk about TIM. Males in 10TIM value the utility of TIM, which includes familiarity with the keyboard and word processing applications, yet the image of TIM as typing is a detraction for them. Some girls are attracted to the typing component of TIM, but not all girls have the same level of interest in this. It seems, then, that it isn't the inclusion of keyboarding/typing skills *per se* that is at issue for students. Rather, it is a perceived emphasis on keyboarding/typing in TIM that is significant. Typing is associated with female secretarial work, and the prominence given to keyboarding/typing in TIM imbues the subject with a gendered (feminine) character in the minds of students.

Beth and Winifred make an overt connection between boys' rejection of 12TIM and the typing component of the course.

R: Hmm. Do you think in general there are any interest areas then that girls have that boys tend not to and vice versa?

B: I hate to say it, but typing. Because in our class there were no boys. Last year there was two but no_ four! But by the end of the year there was only one left so_

R: Why do you think that is? Why do you think there is that difference in interest?

B: Coz_

W: They think it's a girlie thing, eh?

B: Yeah.

W: Think typing is just for girls, I think.

B: It is like in the sixties you would get like mainly female secretaries and things like that. (si 29/8/01)

Beth's reluctance to admit this association, signalled by the phrase "I hate to say it", suggests that she is very aware that she is promoting a gender stereotype of typing as a female practice and of TIM as typing. However, her personal experience compels her to make this announcement. Winifred's reference to typing as a perceived "girlie thing" carries the implication that, in her experience and opinion, boys think of typing and TIM in depreciatory terms.

Students across the subject traditions view TIM as a feminine subject, meaning that it is seen to cater for students interested in traditional female computer practices. Of the students interviewed from the CPS and TIM classes, it is only girls who express an especial interest in the typing aspect of specialist IT courses. This is not to say that all girls are keen on typing or see themselves in traditional female roles. Nevertheless, TIM courses are perceived by students to be more relevant for females than for males because of the association between the courses and traditional female office practice.

There is a durable quality to the gendered subjectivity of both CPS and TIM, a persisting association of the subjects with traditional male and female practices in the minds of students. These subjectivities can be seen to exist both because of and despite ongoing curriculum developments and changes. Although developments in CPS have aligned it with a computer-as-tool paradigm and the subject was developed as an alternative to and an extension on mathematical computing practices, it is seen by students to be “about computers” and is thus positioned within a technological computing discourse. Recent curriculum changes have maintained an association between TIM and applications used in office work, while at the same time distancing TIM from its typing antecedence. Regardless of attempts by teachers to distance TIM from typing, students perceive it as a typing course. Thus, there is a tension between forces for cultural change and others for the maintenance of the cultural *status quo*. This tension and inertia is a feature of curriculum and subject culture. It derives from what Goodson and Mangan (1995) describe as a process whereby subject culture is redefined even as it is reproduced, and *vice versa*.

The tension between durability and changeability in the development of subject cultures and identities at KHS is reflected in the contradictory attitudes and choices of students who participate in TIM and CPS classes; that is, in the acceptance and rejection of particular courses and/or aspects of different courses by individual students. Students’ attitudes to different subjects and their ideas about whose interests they serve are subtle and complex. Although it is apparent that students attribute CPS with a masculine identity and TIM with a feminine identity, there is a quandary in arguing that students construe either subject simply as a subject for boys or for girls. If TIM is viewed as a girls’ subject, why do boys take the

subject in relatively large numbers at year 10? Why is there such a difference between participation patterns between year 10 and year 12? The answer seems to lie in part in structural arrangements that are specific to the curriculum at KHS, particularly in the coexistence of subjects from different and gendered IT subject traditions at year 12 and in the provision of subject choice for students at this level.

Gendered by choice

Harking back to the arguments of social constructionist theorists pertaining to curriculum development (Bruner, 1996; Giroux, 1997; Goodson, 1998; Hargreaves, 1994), curriculum can be thought of as an ideological force, and schools and teachers can be seen as ideological agents. Curriculum is contested at school and classroom levels, where the decisions made by teachers about what should be taught and how the curriculum should be organised may reproduce or challenge dominant social relations and interests. At KHS, the decisions that have been made by teachers to maintain courses from two different curriculum traditions provides subject choice for students. It also, in effect, maintains a distinction between subjects from gendered IT traditions and sets them in competition and opposition with each other. This can be seen as an ideological act that supports a gendered curriculum *status quo* in the IT domain at KHS, however unwittingly or unconsciously this is done.

In years 9 to 11 at KHS, students have little or no choice of subject options from different IT traditions⁸. Text and information management is the specialist IT subject that is available to students. In comparison, at year 12 students have a choice between 12TIM and 12CPS (see Chapter 4). Participation patterns suggest that boys and girls consider TIM to be an appropriate option choice in the younger years. At most levels the TIM classes have a mixture of male and female students, but the differences between the number of females and males in TIM courses appears to be more extreme in the older years (see Tables 15 and 16). This raises questions. Is there something about the subject or students' experiences of TIM in the younger years that leads males to reject TIM as a viable option for them as they progress through their

⁸ In some years a CAD (computer assisted design) course is offered and taught at year 10. It was not taught in 2001.

schooling? Or does the context, the existence of multiple and gendered subject options, alter students' perceptions of the appropriateness of subjects?

There are signals amongst the younger students that both males and females consider TIM to be a viable subject option for them. A common motivation for taking 10TIM is the ubiquity of computers and the perceived utility of TIM for individuals who have a variety of education and career interests. The following are students' responses when asked why they chose TIM as one of their subjects. Nicholas and Matthew:

N: Coz I thought it would be helpful in the future.

R: Is there any particular way that you thought that it would be helpful?

N: Ah_ um_ No not really. Oh, it will help you in_ a range of subjects.

R: Yeah. What about you Matthew?

Mw: Oh, coz I want to be a programmer in the future and I just wanted to improve my computer skills.

R: OK. Do you think it's done that?

Mw?: Yeah.

...

N: Yeah, I'm thinking (of it because it) might be more helpful for, um, because I'm going to be a, um, try to be a architect and it might be helpful with that because it is probably all going to be done with computers, later on. (si 26/10/01)

Luke and Rawiri:

Lu (Luke): Oh I probably thought, because about, coz of, um, out of all the subjects like in the school that you can take, apart from like the compulsory ones, this one will probably help you out the most in life. Coz like quite a lot of jobs need computers. Pretty much anything you do has something to do with computing, yeah.

...

R: ...Do you think you are going to have those skills when you finish this class? ...

Ra (Rawiri): Yeah.

Lu: By the end of next year I, yeah, I will know quite a lot about computers. (si 22/11/01)

And Vicky and Harriet:

V: Because most jobs need a computer.

H: Yeah.

V: Like most jobs now --- use computers. So yeah, it's kind of helpful for a job.

H: That's the way the world is going_ It's basically the same reason for me_ that you will need it for later on. Just need to learn how, like typing is the basic thing on the computer_ which we have learnt, so it's good.

...

R: ...Like now knowing what you know about TIM if you were going into year 10 again, would you still take 10 TIM?

H: Yeah I probably would because it's still gone more in depth from what we did in year 9 but I don't think you would need to do it again because I think we have learnt basically enough that you need to learn, unless you are going to have like a job that is specifically just computers. (si 2/11/01)

These students are motivated by a belief that TIM will furnish them with useful and transferable knowledge and skills. Although Harriet does not intend to pursue TIM beyond year 10, it is clear that she was drawn to 10TIM by the perceived utility of the subject. She chooses not to pursue TIM in subsequent years, not because of dissatisfaction with 10TIM but because she is satisfied that the course has met her need for basic computer knowledge. Similarly, the boys in the 10TIM class construe the course as a useful introduction to computers and accept it as an appropriate subject for them.

Most of the males and females who comprise the embedded 10TIM cases indicate that they are likely to pursue TIM in year 11. Nicholas, Matthew and Luke signal that they intend to select TIM as one of their year 11 subjects, and that they will probably take something to do with computers in year 12. Vicky, Susan and Marie similarly indicate that they are likely to take 11TIM. These students do not make any clear distinctions between 12TIM and 12CPS in interviews. However, it needs to be remembered that at this stage of their schooling TIM is the only specialist computing option that is available to these students. They are making a choice about whether or not to take a computer course. They are not choosing between different IT subjects or traditions.

This situation presents a dilemma. If TIM has a utilitarian function and students value the computer-as-tool construction of TIM, why are there no boys in the 12TIM class in 2001? Why are males who wish to be journalists, business managers, architects, accountants and lawyers, or who wish to pursue tertiary level studies in a range of disciplines, not selecting 12TIM as an option subject? The absence of males from 12TIM suggests that there is something about the TIM course that is in conflict with a masculine identity in the minds of boys, something that outweighs the utilitarian value that they attached to TIM.

When discussing their year 12 subject choices, the boys in 12CPS indicate that they didn't give 12TIM any serious thought. In fact Mason and Ben ask what TIM is, signalling that they either didn't know the course existed when they made their subject selections or, if they did know, that they didn't consider it to be a serious computer course that would suit their needs. The boys indicate that they used computers in typing in earlier years but, in Carl's words, "that's different compared to this [12CPS]" (si 14/9/01). He experienced TIM as keyboarding/typing and disassociates TIM and CPS. When these students were in year 9, the introductory computer course that was available to them was called typing, which changed to TIM the following year. As far as these boys are concerned, a typing construction of computer practice is not a legitimate option for them. This resistance to keyboarding/typing in TIM is also shared by boys, and some girls, in the current 10TIM course. This confirms that there is something about TIM, specifically the association with typing, that has a gendering effect and leads some students, and males in particular, to reject and resist TIM as a viable specialist IT course, regardless of the broader utilitarian functions it may perform.

It could be argued that the boys in 12CPS have an outmoded idea of TIM, which is based on their personal experiences in the subject called typing when they were in year 9, and that over time the perceptions of the subject as a "girlie thing" and gender differences in participation patterns are likely to break down. It is early days for TIM as a subject. However, the Ministry of Education (MOE) statistics for 2002 and 2003 show that although there are some males in 12TIM classes at KHS, they are heavily outnumbered by females (see Table 16). This is in contrast to the CPS participation statistics, where the gender balance has males outnumbering females. Gender associations do not yet seem to be breaking down at KHS, at least not in a way that translates into marked changes in gender participation patterns in year 12 CPS and TIM courses. The way that students talk about CPS and TIM shows that they think of these subjects as masculine and feminine domains. There is something about the subject cultures that leads them to these conclusions. This explains the preferences of males and females for different specialist IT subjects in year 12 at KHS.

Notwithstanding, a case can be made that gendered participation patterns are in part a function of subject choice, which relates to the structure and organisation of the IT curriculum. By

setting up a curriculum with competing subjects from differently gendered IT traditions, students are drawn to make comparisons between subjects. This puts the gendered constructions and cultures of different subjects into sharper relief and exacerbates the differences. Whilst there are theoretically no barriers to males taking TIM courses in the senior school, it is apparent that boys tend to avoid TIM when given a choice of a specialist courses from an alternative (masculine) tradition. They thereby reject the subject they associate most closely with female computer practices and favour that which they think is more consistent with male computer interests and identities. The converse is the case for females. In the act of making choices between CPS and TIM subjects, students both respond to and sustain a gendered IT curriculum culture at KHS, albeit without thinking of their actions in these terms.

One can only speculate from the data available what the situation would be like if there was only one specialist IT subject option in year 12 at KHS, about what subject choices students would make and on what grounds they would make their choices. Presumably this would depend on the nature of the specialist IT course on offer and the tradition from which it derived. It is evident, though, that the TIM and CPS courses at KHS are ascribed feminine and masculine subject identities. Also, that in the context of the gendered curriculum culture that exists at KHS, the provision of subject choice contributes to the creation and maintenance of that culture.

Gender relations and classroom culture

Having seen that students attribute specialist IT subjects, CPS and TIM, with gendered cultures or identities, attention will now turn to the culture of the classroom. Attention is paid to the meaning students make of their experiences with computers and to the gender relations established in the classroom. Students reveal that they perceive a gendered knowledge hierarchy, which establishes participants in CPS and TIM classes in gendered power-knowledge relationships with each other and with the technology. This exposes deep, socially constructed ideas about the nature of computer technology and what counts as technological knowledge. It echoes and supports the critical literature that describes the social construction of technology as a masculine site and the privileging of masculine computer knowledge over

feminine knowledge (Christie, 1997; Clegg, 2001; Clegg & Trayhurn, 2000; Singh, 1990, 1993, 1995; Wajcman, 1991). Also, each class is observed to have a unique social climate. This reflects the unique social mix and gender relations that operate in different classes and are negotiated between students in different courses.

Gendered knowledge hierarchy

A knowledge hierarchy

Students perceive a hierarchy of computer knowledge. They have formed this idea in their experiences inside and outside the classroom. This hierarchy has a gendered character. Students talk of males and females preferring different types of computer activities and having different types of computing knowledge. They intimate that the knowledge held by males is superior knowledge and they judge their own and their classmates' interests and abilities with computers accordingly.

A commonly held idea is that males are more interested in and spend more time with computers, particularly on activities such as computer gaming, programming and loading software. Consequently, males are seen to be more expert at such practices. Joanna's and Xiao-hong's experiences in 12CPS leave them in no doubt that boys are more knowledgeable than girls in regard to programming.

R: So are there any particular programs or applications or things that you have done in this class that you think yeah, the boys seem to be better at that than the girls or vice versa?

J: Oh programs generally. Like_ you see Mason and Scott and they are way ahead. Same with John and Carl and_

W (Xiao-hong): Daniel

J: Yeah, Daniel and stuff. And then if I ever had a question and Mr Lucas was --- I wouldn't ask Kathy or Lisa. I'd ask_ Ben coz, or Scott or something because generally they seem to know. (si 30/10/01)

Whilst students acknowledge girls' ability with computers, particularly in relation to keyboarding and document production, what (some) males do tends to be attributed higher status. Ben, for example, places greater value on the practices in which boys engage.

R: So what, what do you think the guys (that) would spend heaps of time on computers are interested in?

Bn (Ben): Um_ oh interested in, um, quality games or interested in_ um, copying the games or_ doing web pages, stuff like that.

...

Bn: [Girls] Just use it for communication wise on the Internet, and that's about it. You won't find many girls that are interested in strategy games or stuff like that. They just, they go on the Internet to talk to people and chat and stuff like that.

R: So are, are these things that you know from sisters or cousins or home or people at school or_?

Bn: Oh, all of the above. (si 2/11/01)

Ben trivialises the practices in which females engage by stating that girls “just” use computers for communication purposes. In an extension of the above conversation, Ben explains that males use computers for a wider range of activities than do females and that females see the computer “as an extension to the telephone” (si 2/11/01) and tend to spend more time in chat rooms. Activities preferred by females are rated as less important than those that are favoured by males, including Ben himself.

Fiona similarly implies that males tend to be more knowledgeable than females in relation to computers. She struggles to identify computer practices that females might be better at than males – “Um_ [thinking pause] I don't know. Maybe the Internet. My Mum is quite good at the Internet” (si 24/8/03). Fiona makes an unfavourable comparison between her computer knowledge and that which she perceives as male knowledge. Her learning and relatively high level of achievement in 12TIM does not countermand the idea that boys are better with computers than girls.

Students account in a variety of ways for perceived differences in males' and females' aptitude for different computer practices. Some conceive of an innate or natural male need to tinker with technology and a fascination with computer technology *per se*, which is something that they think females do not have or share. For example, Kathy and Lisa talk of a male approach to computers. Kathy says that males tend to work by themselves and “sort of go and fiddle around with the computer, [to] see what they can find” (si 19/10/01). Matthew and Nicholas likewise describe males' apparent interest in playing with computer technology as a peculiar gender trait. It is something about being male.

R: So why do you think... there are perhaps more boys in that technical side? Why do you think boys do that?

N: I don't know. Um_

Mw: Boys and their toys. They like being electrocuted.

N: Yeah.

R: Pardon me?

Mw: They like getting electrocuted.

R: Meaning?

N: We just like, I play round with stuff.

Mw: Yeah_ Blowing stuff up. (si 26/10/01)

Fiona and Angela make a similar case:

F: Um, I think guys do know a lot more about computers – the actual working of them, of how they work and stuff. Like I have no idea, but I only know how to use like Word and stuff like that. Um_ Yeah.

R: Why do you think boys know more about the actual working of them?

A (Angela): Boys and machines.

F: Yeah [quite firm], I think_ yeah. They like their games and stuff as well so they are just like_ um_ I don't know. It's hard to say_ Um_

A: I think it's sort of_ boys and computers and sort of like boys and cars. I think it is just their toys. I think they_ don't really care what they are downloading as long as they are storing *something* [chuckles]. They don't really care what it is. And I don't think they grow out of it either.

R: Have you had any particular sort of experiences when you have got sort of particular people in your life that have lead you to think that? Like who are_ these people that you_?

A: Dad [laughs].

F: Yeah.

A: Dad is always downloading something from the computer and I don't really think he knows what it is half the time. Downloading something or he is fiddling with something ----.

R: You mentioned an Uncle last time too.

A: Yeah.

R: An Uncle that's a sort of computer wiz bang or_

A: Yip. Very much with, um, computers. When he was little he used to take watches apart, to see if he could take them apart and then put them back together and then if he couldn't he'd take them back to the shop and ask for a refund [laughter]. I'm like, that's right. You go! (si 24/8/03)

Angela ridicules the perceived need of males to take machinery apart and signals that this is something in which she has no interest. Nevertheless, she implies that this is an aspect of computing about which males have superior knowledge. Harriet and Vicky similarly talk of an interest in the workings of computers as a masculine trait. They intimate that males and females are somehow naturally inclined towards different computer practices, males for the technical side of computing and females for text production.

R: ...Some people think that boys are better at using computers than girls. Do you think this is true?

H: Well it depends on what aspect of computers. Like if you are talking about, you said before about how computers work and that. I think that would be a more sort of a guy thing.

V: Yeah, like (a computer) technician, but_

H: But using things like the card [greeting cards], like applications and things like that, you would probably think that a girl would be better at them coz probably coz she is more interested in them.

V: --- you could get anyone and train them up for it, anybody can really_

H: Yeah, you can be on the same level.

R: So why is it do you think that boys, um, like those more technical things?

V: I've never actually figured that out! [chuckles]

H: That's just boy stuff. They like, they prefer to play out in the mud and do things like that.

V: But I, I couldn't really say that coz I sort of enjoy doing a lot of that, but yeah_

H: Yeah, but, but, there is just sort of a more_

V: Yeah, it's the image they have got really. I don't know how, but yeah. (si 2/11/01)

These girls think that males and females have different orientations towards life in general, males towards the technical and females towards the aesthetic. These different orientations translate into different computer interests and practices. Males are perceived as less interested, less patient and less willing to apply themselves to keyboarding and document production tasks, the converse being the case for females.

Some students explain gender differences in computing interests and practices as matters of biology. Ben, for example, thinks that males' preferences for violent recreational games is a matter of instinct.

R: Uh huh. So what is it about playing games and stuff like that that appeals to boys do you think, more than girls. It's not that it doesn't appeal to some girls, but_?

Bn: Um, it just, it helps us relax, helps us crash. It, you know, it brings out the guys instinct just to crush, kill and destroy [R chuckles]. So, you know coz if you look at most of the good games it's got blood, it's got explosions, it's got people dying, it's got, yeah. (si 2/11/01)

Others think of gender difference in computing ability as a matter of natural cognitive differences. Kathy, for example, thinks that there is something in the way that boys think that helps them to understand computers better than girls.

R: Any particular types of programs that you think that boys know more about than girls do or vice versa?

K: No just_ just everything really I think. I think they just_ I think they know_ more about the whole_ thing. I don't know, they understand it more_ understand it better.

R: Understand the program [application] or understand how the computer works?

K: Both_

R: And you said that girls just get on with it. Do you think_

S: Well they just_ well_ No, I don't know. They just don't_

R: Do you think that girls don't *want* to understand it as much as boys?

S: Oh some people, with some people, yeah but others_ --- they are trying to understand it but it doesn't always_ click on as fast as what it does for the guys. (si 16/10/01)

Although she acknowledges that some females may have very good understanding of computers, Kathy sees these females as exceptions to the norm. Kathy doesn't talk of any males having problems with or difficulties in understanding computers in her spontaneous comments, a perception that derives in part from her experiences in 12CPS of boys being confident and knowledgeable about computers. Likewise, Xiao-hong thinks that boys think differently, and are therefore better programmers. Joanna speculates that this is due to different brain function.

R: OK. Um, what about you Xiao-hong? Do you think boys are better with computers than girls?

X: Um_ I, I think, I think that is wrong. But, but_ --- the fact that it is right.

J: Yeah exactly. You don't want to admit it but it *could* be right.

X: Yeah

R: So you want to *think* that it's wrong_ but you are saying that, that it might be right?

X: Yeah

J: Yeah

X: Yeah.

R: Why, why do you think it might be right? What experiences lead you to think that?

X: There are ---, um, my friend_ my friend like, ah_ the good at computers are, is lots of boy. Yeah, and, um, I think that maybe --- think more faster.

R: So you think they may be cleverer with computers and think more quickly?

X: Yeah. Yeah. I, I know all this right.

J: We can't be excellent at everything. Maybe they are more logical thinkers or coz they use a different side of their brain or something. I don't know. Coz like_ they can only do one thing at a time [laughter].

...

J: I mean we are OK, we can do it, but sometimes I think they just grasp the idea of it quicker.

X: Yeah.

J: Yeah. Maybe.

R: Just, are you thinking there in the context of programming or in general?

J: Mm, in programming. I wouldn't say in general.

X: No.

J: Yeah. (si 30/10/01)

Others shy away from ideas that there are genetically determined differences in intellectual capacity between males and females and account for gender differences in computer ability as matters of socialisation. Mason, for instance:

R: ...Some people think boys are better at using computers than girls. Do you think this is true?

C: No

M: It's just that_ most people find that_ coz of just the way that everyone is brought up it's_ most guys usually tend towards mathematical sort of stuff and that's computers, and most girls are brought up towards the English.

...

R: Yeah. Yeah_ What about you Mason? You know you are saying that difference between how people are brought up. You have obviously got some experiences or some ideas_ there so can you_ be a little bit more specific about what_ what ---

M: Yes. Well most people in here, like_ like my parents, my Mum like brings my sister up. She doesn't_ My Dad usually looks after me. It's just_ you know, male bonding, female bonding sort of thing, and_ just most girls tend towards English_ subject and that's why they are probably better at word processing and stuff because they can type faster and_ they have got the English skills, and most of us boys are just brought up to like_ watch rugby and stuff like that. So it is pretty much mathematical_ getting --- really. (si 14/9/01)

By not denying the differences in computing ability, Mason implies that he sympathises with the suggestion that boys are more knowledgeable or skilled computer users. However, he softens what could be construed as a politically incorrect or socially unpalatable idea by suggesting that it isn't girls' fault that they don't know as much about computers, it is "just the way that everyone is brought up." He thinks that males are inclined to be better with computers because they are socialised to be interested in things mathematical. He assumes a hierarchy of computer knowledge and privileges mathematical uses over others, thereby privileging his own preferred computer practices.

Nicholas similarly explains females' lack of interest in programming as a matter of socialisation.

R: Yeah. Do you think there are any particular things... like programming and um_ the technical stuff, that boys are better at than girls?

N: Some --- most, people don't think girls usually go for that kind of job.

R: Do you think that they go for that type of job?

N: Some do. Not a *lot*.

Mw: There would be more boys than girls. A few of them do but not, I wouldn't say that many that would. There is more guys in that area. Yeah.

R: Why do you think girls don't do that?

N: I think it is because we are coming out of the age where like girls were not like highly classed. If that makes sense.

R: Can you elaborate? Yeah, I think I know what you mean but if you could explain it, it would be helpful.

N: Ohh! Um, oh you know how like in the old days girls didn't, they had to stay home and wash the dishes and everything. They didn't get any experiences or stuff like that and it was the guys who went out and got everything. And now it's just starting that girls are getting more rein to do what they want. (si 26/10/01)

For him, the lack of involvement of girls in programming is a function of the social conditioning applied to males' and females' different life domains, whereby girls' lives have traditionally been focused on the home and boys' lives on the world of work.

Resistance to gender stereotyping is exhibited by a number of students, male and female, who avoid accounting for gender differences in ways that may be construed as sexist and that present females as less able. Carl is unequivocal in his view that there is no difference in males' and females' ability with computers, and he uses the examples of females in his family and the assessment results achieved by females in 12CPS as evidence of this. Interestingly, he is the least confident and assured of the males in his peer group. He appears to be constantly trying to keep up with John and Mason. He is unable to play computer games, because they make him feel sick, and he gives the impression that he feels less knowledgeable in regard to this and other masculine activities compared with his immediate male peers. However, Carl aspires to have such knowledge and skills and to be able to do the same things as these males, including programming and building computers. He accepts that females have ability and general knowledge with computers, while at the same time privileging masculine knowledge and casting this type of knowledge as superior and desirable for himself. Ben also denies any innate intellectual differences between males and females, despite indicating that he thinks that males' and females' have different computer abilities. He argues that girls and boys have similar potential ability to master different types of applications. His reason for saying this is that "we [in 12CPS] all seem to be scoring about the same or pretty close all the way through" (si 2/11/01). His experience in 12CPS leads him to deny gender based intellectual differences, while his broader experience of computers leads him to describe 'natural' gender differences in interests and therefore in ability with particular computing applications and practices. He also privileges masculine activity.

In another example of resistance to gender stereotyping relating to computing ability, Beth responds vociferously to the suggestion that boys might be better at using computers and shows herself to be acutely aware of gender politics.

R: ...some people think that boys are better at computing than girls_ What do you think about that?

B: [chuckles] Nah, that, that's sexist. No.

...

B: It depends on the person. Like sometimes the boys are going to be better at it. Sometimes the girls are going to be better at it. So it depends on what they know. But, that, that's just sexist! [indignant] (si 29/8/01)

Gini and Emma subscribe to a different-but-equal doctrine.

R: So_ do you think boys are better at using computers than girls?

G: I don't know. I was listening to something the other day and more girls use the Internet, you know, but I'd say guys_

E: I think they are better at a certain_ I think we're equal.

G: Yeah, (same). Yeah.

E: Like we both are as good as each other but they're, we would be better at some things and they'd be better at other things_ They might be better at solving problems, solving stuff than us. We might be better at_ just_

G: We are more the simple kind of_ people, (you know).

E: Getting things right. More accurate than them.

G: And guys would be like yeah, OK next thing. (si 28/8/01)

Emma appears to think better of suggesting that males are better than females. Adopting the position that males and females have different computing interests and approaches to problem-solving makes perceived gender differences in ability or knowledge palatable. Nevertheless, the inference is that males have more complex or sophisticated understandings of computers than do females.

Students adhere to the notion that males and females pursue different interests and therefore have strengths in relation to different computing practices. The interests, knowledge and skills of males are attributed greater status. This gendered hierarchy of knowledge is explained in terms of different and sometimes contradictory discourses – natural inclination, essential cognitive differences and socialisation processes.

The nature of expertise

Associated with the idea that there is a gendered hierarchy of knowledge is the notion that males are more expert computer users than females. Students identify male role models when talking about computer expertise. Males are seen to be more expert because they have the kind of knowledge that counts. Their knowledge tends to be portrayed as superior knowledge. For example:

R: ...some people think that *boys* are better at using computers than girls [Joanna giggles]. Do you think this is true?

J: Probably is. No_ I don't know.

R: What leads you to think that Joanna?

J: I have no idea but I've just found generally in my experience through life_ if I've met someone who is good at computers, nine times out of ten it would be a guy.

R: Can you give any particulars or specifics?

J: Well again like my friend he's 12 and he's like my wee brother and he has got top in all of Australasia and the Pacific with the Australasian schools computer thing and then, like a mate of my Dad's, he's a guy and he's an incredibly good programmer and such. And then_ I don't know, I mean Lise [Lisa] beats Ben a lot of the time though, but you know, like_ I don't know. Scott is quite good and Mason's very good but also I know like Lise and I got the top scores.

...

J: Got the top scores in that last exam.

R: Yeah

J: So_ So it could be right but then it could be wrong coz, maybe they just_ the chicks just go on to_ other types of work, ---. (si 30/10/01)

Male programming experts act as the benchmarks against which computer knowledge or expertise is judged by Joanna, and against which females are found wanting. Joanna recognises that she and Lisa have performed well in class assessments, better than some of their male peers on occasions. However, she does not see herself and Lisa as experts. Success in 12CPS assessments is not what she uses as a prime indicator of expertise. Rather, those males who are skilled at programming are cited as models of computer experts. In this, Joanna recognises a broad social phenomenon where the knowledge and skills of the IT industry, acquired in a computer domain traditionally dominated by males, are valued over other forms of computer knowledge.

Angela describes her father and uncle as computer wizards who are always playing with the technology, which includes loading and downloading software. Fiona similarly cites males as

examples of computer experts, based on their evident interest and knowledge of technology *per se*.

R: [chuckles] What about you Fiona? Who are some of the people; friends, family, others that sort of_ you've obviously had an experience that's made you think; OK boys do like the machines more so_?

F: Ah, my boyfriend's friend and my boyfriend's_ brother. They are like real into computers and they are like always adding more, ah, what's it called, RAM or something. Yip.

A: Who knows what it's called! [laughter].

F: Exactly. Um yeah, they always add. They are always playing games and, yeah, they're never off the computer. They are always on the Internet and um, yeah. Like they start talking and it's like, OK, I don't know what you are talking about [chuckles]. (But yeah)

R: Do you want to know what they are talking about?

F: Not really. Some --- [chuckles].

A: As long as it doesn't break on me I'm right [laughs]. I'm like, that's right. You go! (si 24/8/03)

They describe male computer talk and technical knowledge from which they feel excluded. While Angela and Fiona are uninterested in the technical aspects of computing and both have experienced success in 12TIM that proves their competence as users of computers, they identify technical computing as a male domain and males as experts in this and allied fields.

Winifred subscribes to the view that females are good at using computers. Evidence she provides of this is her observations from past experience that boys need to ask girls for help in TIM classes and that her father and brother have needed her assistance in relation to the use of database and word processing applications. However, she reveals that her model of a real or ultimate expert is a male software engineer.

R: ...So Winifred do you know any boys who are good with computers? Like who have the opposite experience?

W: Oh yes. My uncle.

R: Yeah.

W: That just came out of --- He's quite good with computers. Um_ He's_ Oh he was doing something, um, he's_ oh there, he's got a business or something and he's creating new software. That's what my uncle is doing and he's totally opposite to my brother.

R: So what do you think is most usual say for the, the men or boys that you know? Are they good with computers or not? What would be most usual?

...

W: I think_ nah I think guys are quite good_ Yeah. Overall.

R: And what about the girls_? Yeah. And what about the girls that you know-- kind of, overall?

W: Oh, I think_ not (bad) [she sounds doubtful]_ Oh yeah, I think they are good, yeah.

R: You kind of hesitated then.

W: Yeah. Because my friends, like I said, out of all my friends I am the only one that takes a computer_ or seriously. (si 29/8/01)

Winifred resists the blanket labelling of males as superior computer users. She also suggests that gender stereotypes mean that males find it harder to get involved with computers, by which she means that they find it difficult to express or pursue an interest in TIM. However, her uncle represents a stereotypical male computer expert. She intimates that he is the most capable computer person she knows. Winifred also reveals a tension between her belief that females are good with computers and her experience of being one of the few girls amongst her friends who is interested in seriously pursuing computer knowledge. She, like other students, learns from the social situation in which she lives. This provides contradictory experiences. Her belief that females are good with computers, but that some males are better, derives from her social experiences with computers both inside and outside the TIM classroom.

Students in 10TIM recognise the ability of individual females and males who are achieving well in 10TIM and who act as advisors on computer matters. Vicky and Harriet identify themselves as some of the best students in the class and signal that they would seek assistance from the girls in their immediate peer group or from Matthew. Susan says she would go to Vicky or Matthew for help. Matthew sees himself as a very capable computer user but acknowledges that females in 10TIM “know what they are doing now” (si 26/10/01). Nicholas thinks that the marks that students have achieved for assignments in 10TIM show that the boys have no greater knowledge about how to use computers than do the girls in the class. Rawiri says that girls are better at using computers because they listen to the teacher. Luke talks of males and females as competent computer users, saying that he would seek assistance from males or females who have a computer at home (si 31/10/01). Thus, individual students are acknowledged as competent computer users regardless of gender, which might be seen as providing proof contrary to the idea that males are computer experts and females are not.

Nevertheless, the 10TIM students reveal that, like students from year 12, their life experiences lead them to view males as the ultimate experts with computers. Students consider males to be more expert than females based on the type of computer activities in which males and females engage and the type of knowledge they consequently acquire. Luke, for instance, names both

girls and boys as those that he thinks know most about computers in 10TIM, although he thinks Brent and Tom “probably know the most in the class about computers” (si 31/10/01). These boys have computer interests outside the practices that constitute the subject knowledge of TIM. It is knowledge about computers, rather than familiarity with the applications presented in 10TIM, that defines their expertise.

The idea that males are more expert and have superior knowledge of computers is derived from experience outside the classroom. By the time they enter year 10, students have learnt that technical knowledge about computers is rated more highly than skill with general purpose applications; specialist knowledge of hardware, systems and programming is superior to familiarity with common applications. Students have learnt that computer expertise is a technological site. For example, this is the basis of Nicholas’s admiration for his father.

N: Well, I got most of my information from my Dad because he um, he ah, builds computers and he does all that stuff with them. He fixes them and he just teaches me. (si 26/10/01)

Susan similarly describes a male model of a computer expert.

S: Maybe [I’ll go to] Polytech because my cousin did and he’s a huge computer person. He like gets thousands of dollars a week. I don’t know what he does, but it’s got something to do with big computer tech stuff. (si 21/11/01)

Harriet and Vicky talk with confidence of their growing knowledge of computers, some of which is obtained from working alongside their fathers. Their mothers are described as less confident and competent than their fathers.

R: What about things like installing software and sort of_?

H: I’ve done lots of that coz we have only got our computer last year so all the things we had to install so_

R: And did you do that personally?

H: Um, I did it with my Dad so I know mostly how to do it. But it’s pretty straight forward because it comes out what you have to do [reference to on screen messages].

N: It tells you what to do, yeah.

H: So it’s not that hard to do.

N: I haven’t actually done it but I’ve watched Dad do it so many times on our one.

R: So at home, you obviously have got computers at home so your parents, are they good with computers? Do they use computers a lot?

N: My Dad is pretty good with computers. He usually knows how to get it all (and stuff). Mum’s learning [chuckles]. She’s usually the one that goes “Help!” or something, yeah. So she’s getting there, slowly.

R: What does your Dad use it for mainly?

N: Oh my Dad, oh, he uses games on it. He goes into the Internet. He used to work with computers. I probably use it the most and whenever I lock it up, he fixes it sort of thing, so, yeah.

R: And what about your Mum? What's she using it for mainly?

N: Well she's doing, she was doing a Word course or something so she comes in and practises on the computer.

R: What about you Harriet?

H: My Dad works with computers like every day because he does like timetables for school. And so he uses computers all the time but he's not very good with them. Like he just uses two fingers to type and things like that [laughs].

N: That's like my Mum!

H: But he does it fast enough so it works for him. And my Mum doesn't use it that much but she is starting to use it more coz it's there. But she just uses it basically like, oh she plays lots of card games and that on it. She normally just uses it for Word and that. Like typing out_ like meetings and stuff that's she had, during the day and that, so yeah. And my brother uses it lots for just car racing games and stuff like that. (si 2/11/01)

Vicky and Harriet describe themselves as skilled computer users in the context of 10TIM work, but it is males who manage the technology at home and from whom they acquire new knowledge in the home context. They think of males and females as having different types of computer knowledge and attribute males with expert status over females.

Thus, students at KHS identify males as the ultimate experts when talking about their experiences with computers: Joanna's "little friend"; Ben's friend, Patrick; a friend and the brother of Fiona's boyfriend; Angela's, Carl's and Nicholas's fathers; Winifred's and Susan's uncles; Matthew's friend, Simon. These males are admired for their technical knowledge and ability to manipulate computer technology and to solve problems associated with computer systems. They are admired for having controller attributes. Controller attributes are contrasted favourably with the user attributes that are assumed by females. Expertise is defined as a (masculine) technological site. These assumptions of what constitutes expertise are transferred to students in specialist IT classes at KHS and establish students in gendered power-knowledge relations.

Gendered roles

Students position themselves and their peers in gendered relations of technological knowledge and power. The nature of this positioning reflects both the social construction of computer

expertise as a technological site and individuals' unique, personal negotiations of gender identities in relation to computer technology. Males tend to be positioned as more knowledgeable or expert computer users and females as less expert, albeit competent, users of computers. These are not exclusive categories. Not all males take on the mantle of computer experts and some girls aspire to be experts. However, they are gendered roles that are recognised by students and derive from their experiences with computers over time and in various contexts, including specialist IT classes. As the hierarchy of computer knowledge is gendered, so are the roles that students are attributed and adopt in their interactions with and around computers. I discern three role categories amongst the students in 12CPS, 12TIM and 10TIM at KHS, based on the type of knowledge held and aspired to by the students who comprise the embedded cases in this research. These roles are those of expert controllers, aspirant controllers and competent users.

Expert controllers

Expert controllers are the students who are perceived by their peers and/or themselves as having superior technical knowledge of computer hardware, software and systems. Their expertise derives from their knowledge of traditionally male dominated computing practices. These students are admired for their ability to control the technology – to access and load software, manipulate hardware, program computers, and to bypass copy and access protection barriers. They enjoy experimenting with computers and are interested in learning to master the technology for its own sake. For these people, computers tend to comprise a hobby or sport. They engage in computer gaming and are recognised as people who like to tinker with the technology. They are computer controllers and players.

In the mixed-gender environment of 12CPS, particular males are attributed the status of expert controllers by their peers. In the following excerpt, Ben discusses what he thinks it takes to be a computer expert and attributes Scott with these abilities.

Bn: Ah, I've got a friend and should any --- and if I have any problems I just go to him and he does it all_ like copying games and stuff like that. So I can copy, copy basic games but when it, when it's got copy protection and stuff like that, he does it_ and stuff like that.

R: So that's like outside of the school. These experiences make you think that you are ---

Bn: And because there's, there's heaps of people that are just_ real good at that sort of stuff, and yeah, I just do it to muck around and have a bit of fun and they sort of_ know, know on a higher level and a more advanced, e.g. Scott here.

R: Uh, yeah, OK, so Scott's an example. So are those people that are really good at that sort of stuff, are they boys or girls?

Bn: It usually_ oh I, I wouldn't know. I'd say usually guys_ because girls are more_ out doing other things. (si 17/10/01)

In Ben's experience, females such as his mother and his peers in 12CPS do not have the knowledge of expert controllers. They do "other things", meaning that they either are uninterested in computers or they do not engage with computers in a way that might lead to expert knowledge and status.

Mason is another that is attributed status as an expert controller. Scott sees Mason as one of his few equals in 12CPS, whose ability and interests make it worth consulting with him over computing matters.

R: ...so what would you do [if you encountered a computer problem]? Scott?

S (Scott): I'd just do it myself. Try and do it and then and actually get help if I can't do it.

R: And who would you get help from if you couldn't do it?

S: I'd ask someone else who [is] quite good at computers.

R: And who would that be?

S: Mason. If he doesn't know then we just_ we'll both try and fix it_ so then you get, do_ trial and error. And if that doesn't fix it then we just go and ask Mr Lucas. (si 17/10/01)

Mason signals that he only considers consulting with a small number of male peers if he has problems in 12CPS.

R: What about you Mason? What do you think would be your usual pattern?

M: Um, get annoyed and turn it off.

R: Is there any point at which you ask somebody else?

M: Yeah well as soon as I start having the problem, I usually ask people around me but if they don't have a clue I just forget it. There is no point in trying if nobody else knows. (si 14/9/01)

John and Carl are the people who sit near Mason and with whom he is observed to consult. On rare occasions he also confers with Scott. As far as Mason is concerned, no other students in the class have the knowledge to assist him. These boys see themselves as part of an exclusive group, united by common interest, and they act to maintain this exclusivity by working together and largely ignoring others in the class.

Xiao-hong is the only person to identify a female peer (Ling-ling) as good at programming. In her opinion Daniel, Luo and Ling-ling are very good programmers. Interestingly, she compares herself negatively with these people, despite the fact that she acts as a consultant and interpreter for the Asian students and that Mr Lucas assesses her to be one of the more competent students in her peer group. Xiao-hong looks to students' ability with programming to assess their ability with computers. The expert controller category is thus clearly associated with the particular computing interests and practices that are dominated by males.

Aspirant controllers

Aspirant controllers comprise the students who aspire to learn more about computer control technology, such as programming. They have a variety of computer interests and may engage in computer gaming, but they don't have knowledge to engage in control activities to the extent that experts do. However, they value the knowledge of expert controllers and aspire to such knowledge for themselves. I include in this category Joanna, Xiao-hong, Ben and Carl from 12CPS, and Matthew from 10TIM.

Carl signals that his main activities with computers are applications based, such as using Publisher for school projects and surfing the worldwide web. However, he wants to know more about programming and the Windows operating system, which he thinks will be essential knowledge in a job as a computer technician. Ben is an avid player of strategy games, but he belittles his knowledge of computers because of unfamiliarity with procedures that allow him to override functions such as copy protection. Nevertheless, his purported reason for taking 12CPS is a desire to know more about technical aspects of computing. Joanna and Xiao-hong both say they know little about computer operating systems but they aspire to learn how to program. Matthew displays a fascination with computer technology and his hobby interests involve gaming and downloading software. He wants to be a programmer, but indicates that at this stage he doesn't have any knowledge of programming. These students may have reservations about their current computer knowledge but they desire to know more about the technology, about computer operating systems and programming in particular. Their subject choices are made in the hope that they will advance their knowledge of these aspects of computing. Aspirant controllers comprise a mixed-gender group.

Competent users

Those who are categorised as competent users want to advance their skill and knowledge pertaining to the use of applications that have utility across a range of disciplines. The relationship of competent users with technology is defined primarily by a focus on the end use of general purpose applications, such as word processing, database and spreadsheet software. These users are not particularly interested in computer hardware, programming and computer operating systems. They use computers recreationally, but their recreational engagements tend to be of a different nature to those of expert controllers. Home uses incline towards communication and information functions, such as surfing the worldwide web, visiting chat rooms and using e-mail. However, some individuals may engage in similar hobby activities to those of the expert and aspirant controllers, such as gaming and using the Internet to download software.

The girls in 12TIM qualify as competent users. The 12TIM course is designed to produce competent users and the girls value it for the emphasis given to keyboarding skills, document production and applications that are relevant in a range of school and work contexts. That is why they chose the subject. Lisa and Kathy from 12CPS also aspire to competent user status, given their disinterest in programming and expressed preference for applications pertaining to the production of documents. Similarly, Harriet, Vicky, Susan, Luke and Nicholas from 10TIM have a utilitarian interest in computers and in the 10TIM course. This positions them as competent users.

Like the aspirant controller group, the students in the CPS and TIM classes who display competent user attributes are of mixed gender. However, those who are attributed the position of expert controllers are all male. The power-knowledge relations relating to computer use in specialist classes at KHS thus have a gendered character. The gendered nature of power-knowledge relations is linked to the existence of a hierarchy of computer knowledge. This hierarchy privileges the type of knowledge traditionally dominated by males over the knowledge traditionally held by females. However, the existence of a gendered hierarchy of knowledge and gendered power-knowledge relations does not pre-determine the status and computer interests of individual males and females. Individual students pursue different

interests for personal reasons, born of different experiences with computers in a range of settings and in the negotiation of their possible selves and personal gender identities. Thus, individuals may conform to or resist gender stereotypes.

Classroom climate

Is the classroom climate different in CPS and TIM classes? Do males or females feel more comfortable in the social environment of different specialist IT classes? As already noted, there is a different feeling in the specialist IT classes at KHS (see Chapter 6). The 12CPS and 10TIM classes seem more boisterous than 12TIM. The difference in classroom tone appears to be a function of several factors, including the age of students, class size and gender. Focussing on gender, the mixed-gender classes have a more rumbustious classroom atmosphere than the all-female 12TIM class. Comparing classes at the same year level, there is a harder edge to the verbal banter in the mixed-gender 12CPS class than is observed in the all-female 12TIM class.

The students in 12CPS invariably deny the suggestion that the classroom culture or 12CPS is less enjoyable or friendly for girls than it is for boys. Males and females express the opinion that girls and boys similarly enjoy what is described as a relaxed and friendly classroom atmosphere. Part of students' enjoyment of the class comes from gendered interactions where males tease females and *vice versa*. Students' attribute the level of comfort that individuals have in the social environment of the classroom to the attitudes of individuals. For example:

R: ... some people think that computer classes are unfriendly or less enjoyable for girls than boys. Do you think this is true? If so why and if not, why not?

M: Not really. Most of the girls out there are having a great time. Most of that time is making fun of the boys but_ [laughter]

...

R: Yeah_ So you don't think the atmosphere or the environment or anything is any different than_

M: It is sort of setting their own standards really. It's what they think and they pretty much do what they want. If they sit there working --- (si 14/9/01)

And Ben's and Scott's responses to the same question:

Bn: I reckon it depends on_ it depends on the class.

R: OK. What about your class, the class you are in? Do you think it's more enjoyable, less enjoyable for girls than boys?

Bn: I reckon it would be just as enjoyable or just as unenjoyable.

R: What about you Scott? Do you think computer classes are_ more or less enjoyable for_

S: Well it depends on the attitude of the girl.

R: Sorry – it depends on the_?

S: Attitude.

R: Oh yeah. And what would make it, what would make it more enjoyable?

S: Someone that's easy to get along with. You have got to be friendly, easy to get along with. Be able to take a joke_ Be able, be able to give a joke too. (si 17/10/01)

Scott feels that to enjoy the class one needs to be able to engage in the verbal sparring that he enjoys. It is up to the girls to fit in. Without being aware of it, he is describing a gendered (masculine) classroom dynamic. This is taken for granted as the norm. Students in 12CPS do not question the gendered nature of this social dynamic. Rather, those who have anything to say about the classroom climate assume that it is an individual student's responsibility to fit into the existing, rumbustious classroom culture.

In contrast, the girls in 12TIM are conscious of gendered social dynamics in IT classes. They are inclined to make comparisons and base their judgements on their experiences of TIM in current and previous years, which have taught them that the climate is different in mixed-gender and single-sex TIM classes. When asked in interviews about whether they think having males in the 12TIM class would make a difference, a common thread in the girls' responses is that they think that having boys in the class would change the social environment and provide a distraction, implying that it would have a detrimental effect. Angela, for example:

A: Yeah, I don't think there would be as much gossiping [girl-girl talk]. There would be more whining from us girls, probably.

R: About?

A: Oh tell him to shut up. He keeps annoying me. Mrs Keall! [mimicking] But yeah I think there would be less gossiping and probably less work done as well. (Kind of) being distracted with talking and things... (si 24/8/01)

Beth similarly describes males as a distraction when contrasting her experiences in 11TIM, where boys were present, with her experience in the all-female 12TIM class.

B: Because of like last year. Like_ the girls were, because there were boys in the class, they were all like, um, you have got to, um, I don't know, act a certain way and stuff. But now that there aren't, it's like we are all friends.

...

W: So_ so girls_ Is that what you [Beth] are trying_ are you trying to say that, that with guys in the class girls wouldn't try as hard because there would be like more trying to impress guys? So they wouldn't be concentrating on_?

B: Yeah.

W: Oh! OK.

B: Since it was like last year. I think that is why, um, a lot of us didn't pass because we were all just playing around and stuff, because there were boys in our class. And (they were) cool. But I mean_

R: You said before that they [girls] wouldn't talk as much so_

B: Yeah, like, we wouldn't talk to everyone. There would be like someone over there and then there would be a middle group and then there would be someone over here. And it would all be separated, and the only time, the only thing you would say to each other is "Hi" and "Bye" and that, that was just the limit of (it). That was all you said.

W: Whereas now we are like all over the place

B: Yeah, its just like bla bla ra ra [signals chat], and Mrs Keall is trying to get us to shut up so it is like, yeah. (si 29/8/01)

Beth feels that the 12TIM class is more cohesive and friendly in the absence of males. She also hints that particular behaviours are associated with males' efforts to appear nonchalant and "cool". Winifred talks of males as wanting to be "macho" (si 29/8/01) and Gini describes boys in the sixth form as "loud mouth kind of_ psycho people" (si 28/8/01). Boys are seen to display their masculinity in domineering behaviour. Girls are thought to behave differently in computer classes where males are present; for example, to seek male attention and approval, and to have less interaction with other females. Thus the girls describe differences in classroom behaviour and interactions that derive from gender relations. The social dynamic of the all-female classroom is a positive feature of the experience of the girls in 12TIM . It is something they have come to appreciate.

The 12TIM girls deny suggestions that the social climate of IT classes is inhospitable for girls. However, some suggest that it may be uncongenial for males, based on their TIM experience. Angela jests that the lack of males in the 12TIM class may be because "they find us girls dominating or something" (si 24/8/01). The implication is that there is something in the way that the girls behave or in the numerical dominance of females in TIM that may be discomforting for boys. Students attribute the absence of males from TIM classes to males having different computer interests, rather than to a gendered classroom climate or participation patterns. The existence of an obviously gendered social climate is thus constructed as a symptom rather than a cause of the absence of males from TIM at the senior

level. Nevertheless, a gendered social climate is seen by students to exist in 12TIM. This means that in order to fit in and be part of the class in 12TIM, a student has to be comfortable with a particular (feminine) social dynamic. To be a boy in 12TIM would mean having a strong enough interest in TIM and being personally secure enough to stand in a position as an odd-boy-out in a female dominated classroom. This is something that no boys show a desire to be or to do in 2001.

The girls in 12TIM did not choose to be in a single-sex class. There was no guarantee that it would be so, although previous experience had taught them that it was likely to be numerically dominated by females. Students in CPS and TIM classes do not cite the gender mix of the TIM and CPS classes, or the different social dynamics of these classes, as reasons for their participation or lack of interest in CPS or TIM courses. However, it is apparent that this is a part of their experience of specialist IT courses. Also, the gendered dynamic of the classrooms acts to reinforce the idea that CPS is a masculine domain and TIM is a feminine domain at KHS.

Recognition of gendered social dynamics in CPS and TIM classes should not be interpreted as meaning that these classes are necessarily unfriendly for one or other gender. As already observed, students tend to operate in small social groups within a larger class (see Chapter 6). Individuals' experiences of classroom culture are defined by both what happens in public (whole class) and in private (small group) spheres of interaction. The distinction between public and private activity is highlighted by Elkjaer (1992) as a factor that helps to explain contradictions in males' and females' experiences in the nominally masculine environment of computer science classrooms, where it might be expected that learning and participating in computer sciences classes would be less problematic for males than for females but where this is not necessarily the case (see Chapter 2). In the specialist IT classes at KHS, students create their own social environments. When given the opportunities to organise their own seating arrangements, students position themselves in groups with which they feel comfortable. Matthew, for example, is discomforted by the behaviour of some boisterous, self-confident boys in 10TIM.

R: Do you like this class? ...

Mw (Matthew): Some (our class), some I hate.

N (Nicholas): Most of them I like, yeah, basically.

R: Why, why hate?

Mw: They are so up themselves. They think they are cool and they are not. Take Brent for example. Can we say names?

R: You can. I'm not going to tell [the names].

Mw: Oh, OK. Take Brent. He's really up himself. It's really annoying. (si 26/10/01)

He avoids these “cool” individuals, despite sharing similar computing interests with them, and interacts more closely with a group of motivated, high achieving girls in the class. Matthew appears to identify more closely with these girls and with boys who exhibit a less aggressive masculinity, and he seeks out these students.

Focusing on 12CPS, students experience the class from their positions as members of unique social groupings that have different gender characteristics. Carl, Mason and John sit together, drawn together by a mutual interest in computers. They rarely interact with females in the class. Kathy and Lisa sit together and regularly interact with one another, although they are part of a larger mixed-gender group. They have similar computer interests and appear to have greater personal empathy with each other's frustrations than do others in their peer group. However, this does not mean that females necessarily or always relate most comfortably with female peers, or males with males. Joanna, for example, appears to particularly relish her interactions with Ben and Lisa. Xiao-hong sits beside Luo and regularly engages with him in social and work related discussions in lessons.

Observation of students' interactions in 12CPS suggests that males tend to dominate off-task activity in the public sphere of classroom interactions. This is a source of classroom entertainment for students, whether or not they personally engage in the fun. If some are discomforted by the boisterous public behaviour they do not speak of it as a negative factor in their experience of 12CPS. Although males may tend to dominate the public fooling, they do not necessarily dominate discussions in whole class teaching episodes. Males and females voluntarily prevail in such discussions, including Rick, Joanna, Lisa, Kathy, Ben and Daniel. Also, there is a disjunction between the public and private spheres of interaction. Those who avoid or are excluded from contributing in the public sphere avail themselves of opportunities to discuss the course content and engage socially with their immediate peers in private. They may take leadership roles in this context. Xiao-hong and Mason, for example, have very little

interaction with students other than their immediate peers. They watch the classroom antics from the sideline and find amusement in some incidents, but they are largely removed from the public boisterousness. Xiao-hong appears to be comfortable and secure working with others from Asia and her superior English language skills mean that she acts as guide and translator for her peers in the private sphere. Mason interacts mainly with boys who share a common interest and displays his knowledge privately rather than publicly.

Analysis of student talk and observation of males' and females' interactions in 12CPS and 10TIM reveal complex gender dynamics that belie the idea that male domination of classroom interactions in mixed-gender computer classes creates a social environment that is necessarily unfriendly for girls. The idea that computer environments are unfriendly for girls stems from research relating to computer science classes (for example, Culley 1986) and classroom environments where students may be competing for access or control of the machines (including, Beynon & Mackay, 1993; Purdue, 1994; Vale, 2002). The situation at KHS is different. Neither of these conditions exists. In the context of the mixed-gender CPS and TIM classes at KHS, some girls may be discomforted by the boisterousness of the public domain, but so may some boys, and others may enjoy this social dynamic. Also, unique social environments are created around immediate peer groups in the private classroom domain, within which males and females may or may not conform to gender stereotypes pertaining to their roles and behaviour. The gender dynamics of CPS and TIM classes are peculiar to individual classes. A gendered classroom climate affects students' experiences, but may be experienced differently by individual students. The gender dynamics and classroom cultures established in CPS and TIM classes are a reflection, as opposed to a cause, of gendered subject cultures. However, the existence of gendered classroom cultures creates situations where being a student in some classes, most notably being a boy in 12TIM, is to be an odd-person-out. This reinforces the idea that different subjects are the domains of different genders

Summary

Gender plays a significant part in students' experiences of specialist IT courses at KHS. It influences students' desires and expectations of subjects, and the nature of classroom relations. Students adopt gendered identities as computer users. They identify CPS as a subject for boys

and TIM as a subject for girls, albeit not exclusively so. They experience gendered power-knowledge relationships and describe gendered social dynamics in CPS and TIM classes.

Students' concepts of their gendered selves as computer users influence their experiences and the meanings they make from their involvement in different classes. At the personal level, individuals align themselves with particular subjects or curriculum traditions in the process of negotiating their identities as male and female computer users. Some conform to gender stereotype, and some do not. For example, Susan, Gini and Angela pursue the subject that derives from an office practice tradition of IT and comprises stereotypical female computer practice, TIM; whereas Mason, Ben and Carl adhere to an IT industry model of computing and have chosen CPS as their IT subject. For others the negotiation of self involves resistance to gender stereotype. Joanna, for example, rejects TIM as a subject for her. She pursues CPS as her subject of choice and expresses a particular interest in programming. Thus, student gender identities as computer users are individualistic and varied.

In negotiating their IT roles and subject choices students are creating different masculinities and femininities. Girls such as Joanna and Xiao-hong do not become male by opting into a subject associated with traditional male computer practices. Rather, they incorporate such practice into their feminine identity, creating a particular femininity. In the negotiations of their gendered selves, females accept TIM and CPS as legitimate subject options for females, although in year 12 individuals select between these subjects for their own personal reasons. In comparison, males appear to conform more closely to gender stereotype in the context of the specialist IT curriculum at KHS, which is suggested by their non-participation and rejection of TIM as a viable subject for them. However, this may be merely a matter of appearance. It may be that socially defined notions of what does and does not constitute masculine computing activity are more obvious in the context of the specialist IT curriculum at KHS. I suggest that if the KHS curriculum were defined according to a different paradigm, such as a computer science or computer engineering model, the socially defined restrictions on females' involvement in different computer activities would be more evident.

Students' experiences of CPS and TIM classes at KHS have taught them that CPS is a masculine subject and that TIM is a feminine subject. This is despite national and local

curriculum developments that have created overlap in the content and applications that are addressed in both subjects and a shared technocratic approach to teaching and learning in CPS and TIM (see Chapter 5). For students, though, there are key aspects in the subject content that ascribe CPS and TIM with gendered subject identities and culture; specifically, programming in CPS, and the emphasis on document production and keyboarding/typing in TIM. Students' ideas that CPS is the subject that is best suited to boys and that TIM caters for girls and their interests echo the views of the teachers who have constructed the specialist IT courses of the KHS curriculum in practice. Both teachers and students can be seen as participants in a widely supported and historically powerful gender-IT discourse. They reflect and endorse pervasive social constructions of different computer practices as masculine and feminine sites.

Students describe gendered classroom cultures in specialist IT classes, specifically in regard to power-knowledge relations that operate in the classroom. They describe a hierarchy of computer knowledge. This hierarchy establishes classroom participants in gendered relationships of authority and expertise with computers and with each other. Males are thought to have the type of knowledge that counts, based on their perceived and peculiar interests in programming, building computers and computer gaming – or, more accurately, *some* males are seen to have this type of knowledge and consequently acquire the status of computer experts. It is the experience of students in specialist IT classes at KHS, from their participation in these classes and in life outside of school, that this type of knowledge is the preserve of males. This is not to deny that some female students aspire to the knowledge that will grant them expert status. However, students' experiences with and around computers have taught them that such knowledge almost exclusively resides with males. Students acknowledge that females in CPS and TIM classes are good with computers, that females are skilled and knowledgeable users, and that females are achieving well in their specialist IT courses. They also resist notions that females are naturally inferior in their computer abilities. However, females are not attributed expert status. This is because expertise is defined as a technological site.

Based on their computer interests and the type of knowledge that they have and to which they aspire, students participating in specialist IT courses at KHS can be classified as expert controllers, aspirant controllers, and competent users. These groupings have a gendered

character. They define the power-knowledge relations of student experience and contribute to a gendered IT classroom culture. It also contributes to the establishment of a subtle hierarchy of subjects in the minds of some students. The interests of a few males in programming, gaming and computer systems designates them as expert controllers and of higher status and authority than other users. These males pursue CPS in preference to TIM, when they have a choice of subjects. They perceive CPS as a superior subject, as do the boys and girls who are aspirant controllers. In ascribing a hierarchy of knowledge amongst their peers, students recognise a social reality. This reality is a pervasive, socially defined, gendered IT culture that exists beyond and within the schooling realm, where (male) IT industry knowledge is valued over (female) knowledge associated with the office practice tradition (see Chapter 2). The gendered IT subject and classroom cultures that are students' experience at KHS, whilst unique, can be seen to be the local manifestation of a broader and persistent social phenomenon.

Chapter 8 Discussion

Different though the sexes [genders] are they intermix. In every human being a vacillation from one sex [gender] to the other takes place, and it is only the clothes that keep the male or female likeness, while underneath the sex [gender] is the very opposite of what it is above.

(Virginia Woolf, 1882-1941, *Orlando*, Ch.4 1928)

I begin this concluding chapter by responding briefly to the main research question. The social constructionist perspective and experiential methodology adopted in this research have led me to an awareness of the complexity of the phenomena of gender, curriculum culture and students' experiences of specialist information technology (IT) courses in a specific New Zealand high school and more generally. In the subsequent discussion I cogitate on the primary features of this complexity and signal where and how the findings of this research support or challenge ideas and assumptions in the literature pertaining to gender and schooling in IT. Also, I advocate for a social constructionist perspective and an experiential methodology as lenses that afford views of the complexity of these social phenomena. Finally, I raise some implications of my research findings for IT curriculum policy makers and teachers.

Do students experience a gendered curriculum culture in specialist IT classes in New Zealand?

The simple answer to the research question is “yes”; students experience a gendered curriculum culture in specialist IT classes at Kahikatea High School (KHS), and in all likelihood in other New Zealand secondary schools as well. Students' choices of IT subjects at KHS create gendered participation patterns and they experience gendered subject and classroom cultures in the course of their participation in specialist IT courses. Different subjects are subtly but clearly connected in the minds of teachers and students with male and female computer practices; that is, with computer functions that have traditionally been defined and stereotyped as male or female work and interests.

At KHS the association of computer studies (CPS) and text and information management (TIM) with gendered computer practices persists despite national and local curriculum development in the last two decades that have blurred subject boundaries and notions about what comprises male and female computer practices. The historical circumstances at the school, where there are competing courses administered by different departments and the teachers responsible for course development come from quite different backgrounds, have seen the rendering of a conservative curriculum in practice. It is conservative in the sense that it preserves traditional subject divisions and identities. These divisions have been maintained in the institutional discourse of subject differentiation and choice. The traditional differences between the subjects have sustained a curriculum with a gendered character. In a way, then, students' experiences of the specialist IT curriculum at KHS are inescapably gendered. They are participants in an inherently gendered curriculum culture.

It could be argued that the attitudes and actions of teachers and students at KHS that have sustained a gendered IT curriculum culture do nothing more than reflect a social reality and forces that are outside of their control; these forces construct computing as technological practice and create a symbolic association between technological expertise and masculinity. However, this implies a lack of agency on the part of classroom participants, which this work suggests is a mistaken assumption and oversimplifies the situation. Although there appears to be a strong gender discourse or set of beliefs about what males and females like and 'do' in relation to computers, a discourse that is recognised and sustained by participants in CPS and TIM classes, individual students display highly personalised desires and experiences of IT courses. They make active, positive and pragmatic decisions regarding subject choices and they respond to different IT practices and classroom activities in ways that both conform to and confound gender stereotypes. At the interpersonal level, then, students give meaning to their experiences of particular specialist IT courses in quite different ways. They negotiate their identities as students of IT and as computer users within a subtly but strongly gendered curriculum culture, but this manifests in a variety of responses and attitudes towards IT courses and being male or female does not prescribe *per se* particular attitudes or responses.

Thus, in arriving at the conclusion that students experience a gendered curriculum culture in specialist IT classes at KHS, I find that the issue of gender and students' experience of specialist IT subjects is much more complex than the simple "yes" to the question implies. There is significant variation in the ways that boys and girls experience the curriculum in practice, both between and within gender groups. Students' personal experiences of CPS and TIM courses are unique, even as they are socially mediated and defined within an inherently gendered IT curriculum culture.

Rethinking some assumptions

This research was provoked by anecdotal reports and observations of apparently persistent differences in males' and females' computer interests and in the nature of their interactions with computers in school and work environments. These observations suggested that equity concerns raised in the international literature of the 1980s and 1990s pertaining to the stratification of the curriculum and participation of males and females in different subjects (for example, Beynon and Mackay, 1993; Chen, 1986; Culley, 1986; Vasil et al. 1987) and male domination of computer technology and greater levels of male participation in computer related activities (including Beynon, 1993a; Crawford et al., 1990; Crombie & Armstrong, 1999; Culley, 1993; Hoyles 1988; Littleton, 1996; Watson, 1993) might be as prevalent and pertinent in New Zealand in the new millennium as they were in previous decades. Speculation on this matter invited me to revisit and reconsider the nature of the specialist IT curriculum in practice in New Zealand and, at a more personal level, the nature of students' experiences of specialist IT courses.

Whilst my research is focused on case study classes in a particular school, the findings raise some questions about the nature of the IT curriculum in New Zealand in general and of the gender relations that are fostered around computers in a range of school environments. Although some stereotypes are supported by the findings of this work, other assumptions relating to gender and computing are drawn into question. In particular, I explore and question the ideas that there are boys' and girls' subjects, that computer classes are unfriendly for girls, that there are essential gender differences in how males and females interact with computers,

and that there is a problem with girls in their under-representation in ‘hard’ computing. I suggest that although these ideas have been historically applied in the literature and they may still be valid in some IT and school contexts, they render a superficial view of issues pertaining to gender and IT schooling. My classroom observations and discussions with teachers and students at KHS lead me to the view that gender-IT relations are complex and multi-faceted. Consequently, some assumptions need to be revisited.

Boys’ and girls’ subjects

I think it’s sort of_ boys and computers and sort of like boys and cars. I think it is just their toys. (Angela, si 24/8/01)

Boys and their toys. They like being electrocuted. (Matthew, si 26/10/01)

They [girls] just, they go on the Internet to talk to people and chat and stuff like that. (Ben, si 17/10/01)

Teachers and students at KHS imbue different types of IT courses with gendered identities. This derives from the close association of different computer practices with symbols of masculinity and femininity – males with technical know-how, authority and control, and competitive play; and females with aesthetic, communicative and social functions. The emphasis on programming and the anticipated, albeit misapprehended, emphasis on the technical operation of computers in CPS is justifiably thought by teachers and students to appeal more to males, given the preferences exhibited by males in 12CPS. These views reflect a strong, pervasive and persistent gendered culture of computing, which is manifested in the schooling context. The clear existence of gendered IT subject cultures at KHS supports the ideas of seminal theorists that computer technology is a cultural product that is historically constituted by certain types of knowledge and social practices (Cockburn & Ormrod, 1993; McKenzie & Wajcman, 1985; Turkle, 1984; Wajcman, 1991, 1994). Underpinning the gendered curriculum culture is a discourse that supports the notion that there are gendered domains of computing knowledge.

Theorists talk of the social and historical development of a masculine culture revolving around a variety of technologies, and more specifically of gendered relationships with electronic technology. Such relationships are based on power. Males obtain power by appropriating the prestige jobs involving the design and control of technologies. In contrast, females act as users

or operators of technology. Males design and repair the technology that females use (Wajcman, 1994). Females tend to be borrowers of technology. Male designers and owners loan the technology to female users (Cockburn, 1985). Males are makers and females are consumers. Technology is what males do and what females use (Oldenziel, 2001). It is argued that, in general terms, masculine strength is expressed through physical force, aggression and analytical power in relation to technology. With respect to computers, this is expressed in male domination in the IT fields of abstract computer science and technical management, in disciplines such as computer science and engineering. There is also a sensual delight to be had in manipulating, mastering and controlling technology *per se* (Turtle, 1984; Wajcman, 1991). A passionate interest in computer technology for its own sake and efforts to control and master technology are characteristic of the archetypal male computer geek or nerd. Obsessive pleasure in achieving mastery of technology is observed in the behaviour of computer hackers. This creates a masculine computer culture, or counter culture, that paradoxically establishes a particular group of males as winners who may lack physical and social prowess and would otherwise be seen as losers (Håpnes & Sørensen, 1995; Turtle, 1984). A range of factors are cited to illustrate how computer technology has been historically defined as predominantly masculine technology, despite the image of computers as clean machines, the sedentary nature of computer work, and the requirement for precision and dexterity with the keyboard. It is argued that girls learn at home and school that computers are just for the boys (Wajcman, 1991). This is because computing is associated with traditional masculine subjects, such as mathematics and science, computer hardware and games are marketed primarily for males, and parental and teacher role models promote computers as a male domain (AAUW, 2000; Crawford et al., 1990; Culley, 1993; Sanders, 1990).

There is clear evidence in the interview and conversation records of students in specialist IT courses at KHS that they adhere to the stereotype that computing is a technological site and a masculine domain. However, they do not learn that computers are just for boys. Rather, they learn that some computer activities are predominantly, but not exclusively, the realms of males or females. Programming and adventure gaming, for example, tend to be pursued and dominated by males, and keyboarding/typing to be dominated by females. Also, students learn that particular and different forms of knowledge are held by boys and by girls. It is a social reality of their experience that computer knowledge is a matter of gender. Students describe a

hierarchy of computer knowledge, where the type of knowledge that males are perceived to hold is privileged over that of females. This establishes students in gendered relationships of power/authority based on their computer knowledge and interests.

Students in CPS and TIM classes define computer expertise as a technological site. They thereby imbue a particular group of males with expert status – the game-playing, software and systems engineering computer enthusiasts. The students who are deemed by their peers to hold this status are all males. Also, students almost exclusively portray fathers, uncles and brothers as the computer experts in their families. Those students in the case study classes who are interested in flight of fantasy games and in building and playing around with computers are all males. Of the students who comprise the embedded cases in this study, Mason and Scott fit the profile of the computer expert and are attributed this status by their peers. They display the passionate virtuosity described by Wajcman (1994) and Turkle (1984) that is a characteristic of male computer enthusiasts in the technological frame, and of computer hackers in particular. The students who aspire to careers in the IT industry are predominantly male – Carl as a computer technician; Mason, Matthew and Xiao-hong as programmers. Even the TIM girls who are passionate advocates for TIM and vociferously resist any suggestions that females may be less able computer users than males hold with this concept of computer expertise.

There is a tension, then, between students' principled resistance to gender stereotyping and assumptions of female inferiority and their experiences to the contrary. Students experience and recognise a broad social phenomenon and socially constructed reality that defines computer expertise in technological terms. This confirms the stereotype of computing as a masculine domain or, perhaps more accurately, of particular types of computing practice as male domains. Also, it leads them to view knowledge and acuity in particular fields as a masculine trait. Expertise is clearly associated with traditional male computer practices. It is defined as a technological domain and males are seen to be the primary keepers of technological knowledge relating to the operation of the machine. Stereotypical notions that males and females *tend* to prefer different computer practices persist, as does the idea that technological expertise in IT is something that (some) males have.

Although one might agree with the idea that computing is socially constructed as a masculine domain in New Zealand society in general, and at KHS in particular, the situation is more shaded and complex than the generalisation suggests. For one thing, no specialist IT subject at KHS is the exclusive preserve of one or other gender. There is a history of male and female participation in CPS and TIM courses at KHS, albeit with variation at different year levels. Computing has been made accessible to males and females through the provision of utilitarian courses at all levels. Also, the computer-as-tool construction of the specialist curriculum that has been implemented at KHS distances IT courses from models of 'hard' computer science and engineering. Theoretically, it could be anticipated that this would appeal to a broad student body, given the evident interest of students in learning about computers as a way of supporting their daily study, work and social activities. Regardless of gender, students in the case study classes unanimously express interest and pleasure in using and learning about computers. This is perhaps to be expected given that the students who are participants in this study have all voluntarily elected to take a specialist IT class. However, it demonstrates that an interest in learning with and about computers is not the preserve of one gender. The ubiquity of computers in life in the twenty-first century and the elevation of computer literacy to the position of an educational basic in a similar vein to reading and writing has softened the gender stereotype of computers and computing as male practice.

Computer classes are unfriendly for girls

Most of the girls out there are having a great time. Most of that time is making fun of the boys but_ [laughter]. (Mason, si 14/9/01)

[We get on] Just as mates, you know. Everyone is generally friends with everyone else. Everyone can get on and have a laugh at each other's expense and stuff. (Angela, si 30/10/01)

The idea is refuted that the culture of computer classes is an unfriendly environment for girls. This idea is implied in the literature of the 1980s and 1990s that describes computing as a male domain and depicts male dominance of activity in mixed-gender computer classrooms. For example, Beynon (1993a) reports situations where boys were more aggressive and dominated the computer hardware, and where physical and psychological barriers were presented to girls that discouraged them from participating in computer classes and clubs. Littleton (1996) suggests that observations from classroom based research of secondary and

primary students' classroom interactions "have raised the possibility that girls' lack of engagement with computer-related activities may, at least in part, stem from their often unsatisfactory experiences of computer use within classrooms" (p.86). It is not disputed by me that computer related classes have historically been hostile for girls and that they may still be so, particularly when computing is defined as 'hard' computer science or engineering and based on a mathematical or applied mathematics paradigm and where females are a distinct minority. However, computing in New Zealand schools in the new millennium comprises a broad range of subjects and possible applications, and the experiences of girls in CPS and TIM classes at KHS does not support the idea that females as a group find the learning environment in specialist IT classes discomforting.

Focusing on 12CPS at KHS, a mixed-gender class and the subject most closely allied to traditional male computing practice, there is little evidence that females as a group are alienated by the subject or classroom cultures in operation. My observations of classroom interactions in 12CPS contravene the finding of Culley (1993) that girls are reticent and often make no contribution to class discussion. The girls in 12CPS do not appear to be any more reluctant to participate in class discussion than some of the boys in the class, and some girls are considerably more forthcoming in the public sphere than some of their male peers. Joanna seems to revel in the construction of CPS as independent endeavour and to enjoy competing in the public and private spheres of the classroom. Xiao-hong appears to be reticent to contribute in the public sphere of the 12CPS classroom, but she seems relaxed and comfortable in the private sphere. In contrast, Kathy is observed to contribute to class discussion and public banter, but she also shows signs of alienation. She appears to be discomforted by the emphasis on independent work and her expectations of 12CPS are at odds with the course content and pedagogy. Also, there is tension in some of her interactions with Mr Lucas. Kathy seems to feel that she does not belong in the 12CPS class. Lisa is similarly dissatisfied with and put off by the programming aspects of the 12CPS course. However, these two girls also seem to enjoy the verbal cut and thrust that is a characteristic of the classroom social interactions.

Thus, the assumption of broadly similar experiences for girls in IT classes is disputed. Whilst a disjunction between expectation and reality with regard to subject content and social tensions may have led to alienation for some girls in 12CPS, this cannot be construed as a

universal phenomenon for the female students in 12CPS or other IT courses. It may well be that some computer environments are peculiarly male in spirit and unfriendly to females and that in such environments females experience profound alienation, as described by Wajcman (1994) and Turkle (1984). However, this is not observed to be the case for females as a group in the context of specialist IT courses at KHS in 2001. Alienation, then, can be seen as a possibility but not a necessary condition of girls' experiences of computing courses. In this I echo the findings of international research that highlights exceptions and contradictions to accepted views that females are uncomfortable in a male computing culture. For example, Bjorkman et al. (1997) find that half the women in a Swedish university computer science programme appear to adjust to the dominant culture and do not feel that they experience gender related problems, while half have a different and more difficult experience. Elkjaer (1992) sees benefits for the girls who have guest roles in IT classes and difficulties and tensions for the boys who are the hosts in these classes and are consequently under constant pressure to dominate in terms of subject competence. However, it needs to be remembered that 12CPS at KHS is an introductory course in the computer-as-tool paradigm. Direct comparisons cannot be made between the experiences of students in 12CPS and that reported in literature pertaining to computer science and engineering courses.

Essential gender difference

[It is] just the way that everyone is brought up it's_ most guys usually tend towards mathematical sort of stuff and that's computers, and most girls are brought up towards the English. (Mason, si 14/9/01)

It depends on the person. Like sometimes the boys are going to be better at it. Sometimes the girls are going to be better at it. So it depends on what they know. (Beth, si 29/8/01)

The findings of this thesis also challenge the notion that there are essential male and female ways of doing computing; that is, that there are natural cognitive differences and ways of engaging with computers and performing computing tasks. These differences are sometimes described as learning styles (Culley, 1993; Hoyles, 1988). It is not disputed that some males and females may approach computing tasks differently, but the application of such differences as a universal principle is questioned. There are exceptions and contradictions in what are supposedly male and female computing approaches. It is therefore difficult and potentially misleading to assume differences as essential cognitive features.

Scott, for example, is a self-confessed hacker. He is observed to exhibit passion, competitiveness, aggression and independence in his interactions with computers in 12CPS. According to Turkle (1984), who is the inspiration of much subsequent work that assumes gender differences in computing (programming) approach, Scott could be expected to have a logical, abstract, planned approach to programming because this is the 'male way'. However, Scott's approach is observed to be anything but orderly and systematic. He tinkers, experiments and ignores the rules and conventions taught in 12CPS. The end in programming is to master and control the machine. Programming procedures and languages are ostensibly logical and orderly. The programming process, though, may be very instinctive and interactive as undertaken by an individual. The hacker like Scott and the boy like Mason who experiment with the hardware and try things just to see what they do, borrowing bits and pieces to create a new machine, could be viewed as tinkers in the tradition of the *bricoleur*. The intuitiveness of the *bricoleur* is characterised as a female trait by Turkle. There is thus a contradiction in the assumption that the experimental, creative, tinkering behaviour that is displayed by male computer nerds is *per se* a male trait.

At the same time, boys like Luke and Rawiri in 10TIM do not seem to approach the tasks they are given to do with a computer in any perceptibly different way to girls in the class. In 10TIM the students work through activities systematically, as they are presented to them on task sheets, and solve their problems through trial and error and by consulting with their peers. They are not working on programming tasks, but if there is a particular and essentially male approach to computing wouldn't one assume that males and females would do things differently in a range of computing contexts? Thus the blanket labelling of boys as 'hard' masters and girls as 'soft' masters is potentially misleading.

In a similar vein, assumptions that males naturally prefer competitive and independent work and that females prefer cooperative activities around computers can be questioned. Whilst some commentators contend that the creation of cooperative, group oriented learning environments is likely to make computing more palatable for females (for example, Blakely, 1994; Selby & Ryba, 1993), this is perhaps best viewed as a possibility for some but not a probability for all. Underlying calls for a new and collaborative learning environment is an

assumption that computing is an antisocial activity. Also, a gender dichotomy is assumed, whereby males are viewed as naturally independent or competitively minded and females as naturally cooperative and collegial. Observations of the CPS and TIM classes at KHS raise questions about these assumptions. Several males are observed to enjoy competition with the machine and with each other, but this does not necessarily make them antisocial. Mason, for example, seeks out and sits with boys who have similar computer interests to his own.

Although Mason is observed to have little to do with others in the CPS class, within this small group he regularly consults and collaborates on computing activities. He, like others, engages in parallel learning in the private sphere of the classroom. Students in the CPS and TIM classes actively seek the assistance of peers and collaborate to complete the learning activities, even within the essentially independent, individualistic pedagogy that operates in these classrooms. Some girls – Joanna, Vicky and Harriet – indicate that they like the emphasis on independent work in CPS and TIM classes. Two students who are observed to display the greatest dependence on others are Kathy, a girl in 12CPS, and Rawiri, a boy in 10TIM. These two students seem to need to interact and collaborate with others in order to achieve and to build confidence in their ability to perform the computing tasks at hand. I contend that the preferred approaches to learning with computers exhibited by Kathy and Rawiri reflect the practical and vocational orientations of these students and/or their limited prior experience and confidence with particular applications. They do not represent any fundamental gender characteristics and differences in their approaches to working with computers.

Turkle (1984) does not claim that all males are ‘hard’ masters and she presents examples of boys who approach programming in a ‘soft’ manner, even though she states that “girls tend to be soft masters, while the hard masters are overwhelmingly male” (p.108). However, subsequent literature suggests that there has been a tendency for commentators to essentialise on the basis of Turkle’s and others’ observations of male and female differences in approaches to computing. This gives concern to theorists who challenge the essentialist discourse of gender (Bryson & de Castell, 1995, 1998; Clegg & Trayhurn, 2000; Trauth, 2002; Wajcman, 1991). Clegg (2001) argues, for example, that formal and creative methods of computing do not constitute intrinsically male or female approaches, but that the “simple dichotomy of hard/soft, male/female is an ideologically constructed fixing of ideal masculinity and femininity” (p.317). The essentialising of gender and the creation of male and female

categories automatically establishes binaries. It places male and female in opposition with each other through dichotomies such as hard-soft, abstract-concrete, objective-subjective, logical-intuitive, aggressive-passive (Mahoney, 2001). This leaves little room for contemplation of the subtleties associated with the social construction of multiple masculinities and femininities that are described in the gender literature (Connell, 2002a, 2002b; Kimmel, 2000; Mac an Ghaill & Haywood, 1998) and in the work of developmental psychologists who describe multiple representations of gendered adolescent selves and highlight the importance of context in the development of personal concepts of self (Curry et al., 1994; Harter, 1999a, 1999b; Markus & Nurius, 1986). In the words of Fischer (in the foreword to Harter, 1999a), “Gender differences depend on combinations of masculine and feminine characteristics and identifications, with wide variations among girls and among boys” (p.ix).

My research has highlighted subtleties and nuance in the social creation and negotiation of gender identities and in students’ interests and preferences for different computing practices and ways of engaging with computers. This leads me to challenge the idea that there are essential gender differences in relation to students’ approaches to computing. It is my contention that individuals exhibit different approaches to computing, depending on a range of social factors. These include prior experience with computers, personal interests and aspirations, and past and current schooling experiences. A boy or a girl may be more or less competitive, more or less cooperative, and more or less intuitive or systematic in his or her approach to computing. Some males and females may interact and behave in different ways with and around computers, but I suggest that this is learned social behaviour rather than a matter of essential cognitive difference.

A problem with girls

If one questions the idea that there are essential gender differences in males’ and females’ ways of engaging with computers, one is also drawn to question the nature of the supposed ‘gender problem’ that derives from females’ perceived lack of engagement with some forms of computing. This study casts a diffuse light on the ‘problem’ of females and their under-representation in ‘hard’ computing that is presented in the New Zealand research literature and

popular media (Churchman, 1993; Martin, 2003; Ryba & Selby, 1995; Selby & Ryba, 1993; Smith, 2001). What it shows is that the nature of the problem and the supposed reasons for the predicament may need rethinking.

In particular, the tendency to blame females and assume that they are naturally disinclined to like 'hard' computing practices is resisted by me. Some boys and girls who are engaged in CPS and TIM courses at KHS certainly display preferences for different types of computer activity. But there are also boys and girls who show no interest in pursuing further specialist computer education. They see computers as a tool and the value of computer education is seen to be in acquiring knowledge and skill with general purpose applications. I do not dispute that there are gendered domains of computing practice. I do, however, dispute that the gendering of these domains is attributable to essential or innate gender differences. Rather, I see males' and females' preferences for different computing activities as a function of the social construction of gendered computing cultures. This means that the 'problem' of females and their under-representation in 'hard' computing is attributed to broad social structures that teach females (and males) that some practices are not for them, rather than being seen as a problem with females *per se*.

No ground swell of concern at the lack of males in traditional female roles is detected in literature or the popular media that is commensurate with concern about the lack of females in traditional male computing occupations. Why not? Why is it that males are not seen as deficient for resisting work in the office practice tradition? Why is their thinking not proclaimed as faulty? I contend that this is because of broad social processes that have associated technology, and computer technology in particular, with masculine symbols of control, authority and expertise. These associations are evident in the descriptions given by students at KHS that cast computer expertise as a technological site. These students are operating within a society in which these gender constructions are pervasive and powerful. The inclination of some commentators to blame females for their lack of involvement in the IT industry and in 'hard' computer science and engineering courses is itself a reflection of the social structuring of gender and IT, which sets what (some) males do as superior. I concur with others who locate the 'problem' of perceived gender inequities in IT with the social construction of technology (including, Bryson & de Castell, 1998; Clegg, 2001; Clegg &

Trayhurn, 2000; Jenson & Rose, 2003) and with socially constructed discourses of computer competence and gender-technology relations (including, Singh, 1995; Stepulevage, 2001). Although gendered IT participation patterns in CPS and TIM are a reality at KHS in 2001 and girls in specialist IT classes show a distinct lack of interest in some traditional male computing practices, such as systems engineering and the work of computer technicians, this is not attributed by me to personal deficiency or innate female inadequacy.

In the New Zealand context and on the basis of research conducted in the early 1990s, Selby (1995) notes that many girls at high school lack an understanding of computing as a career and she sees this as an important factor in girls' decisions not to do computing courses at the tertiary level. Whilst this may be true, my work with the students at KHS leads me to see the 'problem' more in terms of underlying social structures and of processes of personal identity formation. The social construction of IT as a (masculine) technological site has already been discussed as a factor that maintains gender stereotypes and discourages female involvement in 'hard' computing. Focusing at the personal level, it is clear that students in CPS and TIM courses at KHS in 2001 are negotiating their personal identities and possible selves as computer users, which is reflected in an array of masculine and feminine constructions. By the time they get to year 10 they have developed ideas about who they are and who they want to be, which are further negotiated in their schooling experiences. All the students who comprise the embedded cases in CPS and TIM classes have a feeling for the type of computer knowledge they will need in their future work and lives. For most students this does not entail specialised knowledge and careers in the IT industry. The reality for the majority of the students who are engaged in CPS and TIM courses is that they can and will work with computers without needing to pursue computer science or engineering, whether they are vocationally or academically oriented. Students may not have detailed knowledge of computing careers, as Selby suggests, but nor do they appear to really desire this knowledge. For individual males and females – whether they are aspiring accountants, architects, travel agents, zoologists, journalists, chefs or businesspeople – this is not a personal problem. Providing knowledge of IT careers may in time encourage some to pursue work in the IT industry – maybe students such as Joanna, Xiao-hong, Carl and Ben, who identify as CPS girls and boys – but I suggest that it is unlikely to do so for others. Although Joanna has been exposed to programming in CPS and enjoys this activity, her CPS experience hasn't led her to

aspire to a career in IT rather than in business. It is moot whether she and others are put off IT careers, or whether it is just that other things appeal more. In a society where computers are ubiquitous and where a basic understanding of common applications can be acquired in CPS or TIM courses, there is no particular incentive to go beyond these courses unless individuals anticipate a career in IT. Paradoxically, the ubiquity of computers in everyday life in the twenty-first century and the provision of general purpose IT courses appear to be factors that act against the wider involvement of females in 'hard' computing. Deciding against pursuing computer science or engineering is not indicative of disinterest in computers, nor necessarily of antagonism to practices such as programming. Rather, it is a pragmatic decision made when adolescents balance their options in the realisation of their possible selves as computer users and adults in the world of work.

Some of the girls at KHS display a clear desire to avoid those computer practices and behaviours around computers that they see as peculiarly male and rather odd. Angela and Fiona in 12TIM, for example, ridicule in a friendly manner the male computer enthusiasts who display passionate interest and virtuosity with systems and hardware management. They are evidently put off pursuing such interests themselves, perceiving these as part of a male culture to which they do not belong. However, they both display assertive femininity and seem to be unconcerned at being excluded from this male club. They do not *want* to belong. They don't wish to be seen as girls obsessed with technology for its own sake. Nor do they give any indication that they see themselves as disadvantaged by standing outside the male cult of the technological. They present as girls who are creating positive futures for themselves; who are actively constructing personal identities as confident, competent, knowledgeable, skilled computer users. In this they conform to the phenomenon described by Durndell et.al. (1995) and Siann (1997) whereby females make constructive decisions not to pursue work and careers in the IT industry. Instead they make decisions about their lives and futures for reasons of positive self-interest. Girls such as Angela and Fiona can be seen to be positively resisting notions that girls should fall into line with masculine computing practices.

The deficit discourse positions females as the losers because they are under-represented in the IT industry and associated fields of education. However, this isn't necessarily how females see the situation. The problem of the absence of females from the IT industry is perceived as a

problem by policy makers and commentators, but not necessarily by individual females who are proactive in their decisions not to pursue computer science or related fields. This leads me to question whether there is a problem at all; and if there is a problem, where does the problem lie? It is clear that there are gender differences in students' interests and involvement in IT. However, the idea that there is a gender problem, specifically a problem with females, is underpinned by the idea that what (some) males do with computers counts more than what (most) females do. It could be argued that there would be no problem if the tendency to privilege male practice were undermined. However, this is unlikely and unrealistic given the potency of the symbolic association of masculinity with technology and the pervasiveness of the discourse of computing expertise as a technological site. It is enshrined in economic, social and educational structures and rewarded through the status and authority that accrues to those in the IT industry. The problem remains, but it is a problem with the social construction of IT as gendered practice, not a problem with males or females *per se*.

Towards a critical perspective

This thesis is located broadly within a social constructionist ideological framework. More specifically, it draws on and contributes to the critical discourse pertaining to gender and IT schooling. The critical literature problematises social phenomena such as gender and IT. It explores that which is taken-for-granted in the definition of what counts as IT skill and knowledge, and how ideas of computing as masculine practice have been produced and reproduced. For example, Jenson and Rose (2003) contend that a masculinised culture of computing contributes to teachers' misuse and disuse of new technologies. They argue that changing this situation is contingent on understanding the socio-cultural space in which the identities of teachers are produced and reproduced. Clegg and Trayhurn (2000) challenge the persisting tendency to define computing in terms of male activity. They argue that a range of ICT courses, which involve a broad array of skills, should be regarded as real computing, not just those based on formal analysis and design methods. Like these critical works, the findings of this thesis identify a persistent tendency for males and females to prefer different computer activities and to participate in different types of IT courses, and I look to socio-cultural factors to explain the discrepancies. Rather than perceive these differences as a problem with girls and

boys *per se* and perpetuate a deficit discourse, I locate the ‘problem’ of gender and computers with the social construction of technology as a gendered (masculine) domain and with gender-technology relations that define computer expertise in terms of (masculine) technological competence.

Also, the critical literature highlights the complexity of gender-IT relations. Attention is paid to differences between and within gender groups and to how gender-IT relations are subject to ongoing negotiation and reproduction. Vale (2002), for instance, illustrates the diversity of girls’ experiences, behaviours and identities in computer based mathematics classes, while concluding that girls are overpowered and marginalized in two different computer environments – a laboratory class and a laptop class. Throughout this thesis I have endeavoured to highlight the complexity and subtlety of boys’ and girls’ personal experiences, to challenge the simplistic male-female dichotomy that is often assumed in gender research. In this I have followed the lead of others who have sought to look under the surface of general trends and to focus on the variation and uniqueness of students’ IT schooling experiences and the complexity of gender identity formation. This concern with complexity can be seen as a disruptive activity, aimed at challenging assumptions of what counts as normal and questioning the veracity of generalisations relating to boys’ and girls’ experiences of computers and IT courses. Also, it acknowledges the plurality, relativity and evolving nature of gender and gender relations (Connell, 2002b; Stepulevage, 2001).

Social constructionism has been criticised because of the propensity of some early social constructionist theorists to essentialise gender (Bryson & de Castell, 1995) and to generalise across genders and focus on the group level of analysis (Trauth, 2002). Critical analysis has been denigrated by some post-modernist theorists for presenting a gloomy or defeatist posture, for creating tragic stories of preordained and inevitable misfortune for females (Bryson & de Castell, 1995, 1998). This, I think, is a pessimistic and limited view of social constructionism, and in particular of critical theory and analysis. Rather than being gloomy, I see the critical perspective as realistic. In this I concur with Clegg (2001), who argues that the value of critical theory is that it recognises social realities. She is critical of post-modern perspectives, describing these as idealistic. She argues that they tend to collapse everything into discourse and language and to idealise technology, exult technological progress and make grandiose

claims about the liberating possibilities of technology. In contrast, a critical perspective recognises the potency of different discourses and possibilities for change while at the same time locating these in the real-world context of social structures, material power, inequality and persistent gender differences.

A critical perspective also offers an alternative approach to both liberal feminism and the radical feminism (also known as cultural feminism) that emerged in opposition to liberal feminism. Liberal feminism tends not to question existing power structures; it assumes that gender differences in computer use can be broken down simply by achieving better access to computers within existing institutional arrangements, and by providing broader experiences of computing through positive discrimination and interventions designed to break down gender stereotypes (Adam, 1997; Wajcman, 1991). Radical feminism emphasises gender differences and reifies these differences; the specifically feminine – for example, humanism and nurturance – is exalted for its own sake and there are calls for the creation of an identifiable feminist science, which does things the ‘female way’ (Wajcman, 1991). Liberal feminism can be criticised as naïve in assuming gender neutrality for social institutions, while radical feminism can be challenged for its naïve biological essentialism. A critical perspective invites one to question both the nature of existing power structures and the taken-for-granted ideas about what constitutes ‘natural’ gender characteristics and gender differences.

Towards an experiential methodology

This thesis also supports the development of an experiential methodology for research in the field of gender-IT relations. An experiential methodology grounds theory in the real-life experiences of people – in this case in the experiences of students in specialist IT classes. Such an approach gives a privileged position to classroom players as knowers. They know what it is to experience a specialist IT course; they know what it is to be a male or female student or teacher of IT and a computer user. Their voices need to be heard. This means it is incumbent on the researcher to make space for them in the research process, both in the data collection and in the analysis and presentation of the data. Hence the heavy emphasis in Chapters 5, 6 and 7 of this thesis on the experiences of students, told in their words as far as practicable. Another feature of an experiential methodology is that it recognises the situated nature of

experience. Consequently, an effort is made to observe players *in situ*. This led me to base this research on a combination of interviews with teachers and students, audio taped classroom conversations, video taped records of classroom activity, and participant observations of classroom interactions and individual students' behaviour.

Others have used a similar methodology. For example, the data for Singh's (1995) exploration of pedagogic practice with computers was collected from six primary school classrooms and included audio taped records of student interactions and interviews with students and teachers. Elkjaer's (1992) findings are derived from participant observation and interviews conducted with 14 and 15 year old students from IT classes. To explore the experiences of girls in grades 4 through 7 who were involved in an IT intervention, Jenson et al. (2003) draw on observational field notes, conversational field notes, and audio and video taped interviews. Schofield's (1995) book about computers and classroom culture derives from classroom based research. Some researchers have emphasised interviews as a mechanism to help them understand people's experiences. For example Trauth (2002) interviewed female IT practitioners and academics in her investigation of socio-cultural influences on the professional development and working lives of women in the IT profession. Clegg and Trayhurn (2000) conducted narrative interviews with men and women on applied university IT courses as the basis for their theorising on the 'problem' of gender and IT. Jenson and Rose (2003) visited schools and interviewed IT teachers, support staff and administrators in their exploration of IT teachers' working identities. These works stand in methodological contrast to the positivist empirical research that is based on questionnaire surveys and statistical records; for example, Chen (1986), Colley and Comber (2003), Durndell et al. (1995), Siann (1997) and Vasil et al. (1987).

An experiential methodology, which is concerned with the lived experiences of people in particular social environments, broadens the frame of gender and IT research. Clegg and Trayhurn (2000) note that research pertaining to gender and IT has tended to focus "away from an analysis of the role of education and the reproduction of gender inequalities towards a narrower set of questions about why women and girls do not choose technology courses" (¶ 3). An experiential approach moves gender and IT research beyond simple equity/access methodologies, which tend to rely on tools such as attitudinal questionnaires and surveys that

supply participation statistics. This is not to say that such methodologies are inappropriate. I suggest that positivist work is very important as a means of establishing patterns and context, hence the use and reporting of statistical and questionnaire data in Chapter 4 of this thesis. However, I contend that greater depth of understanding about why gendered patterns of participation and IT preferences are reproduced is afforded by an experiential methodology. In adopting an experiential approach one focuses on the micro-sociological relations of everyday life in schools and classrooms, located within an acknowledged historical and structural context. This enables one to look at what is happening ‘on the ground’ and to get a feeling for the variation and nuance in people’s experiences. An experiential methodology affords a better view and understanding of the complexity of the gender-IT relations and of the gender ‘problem’.

An experiential methodology aims for depth of understanding of social phenomena and of the situated character of phenomena, rather than to make broad claims or generalisations across a range of settings or contexts. In this thesis the phenomena of students’ experience and IT curriculum culture are explored in the context of a particular school, KHS. Nevertheless, KHS can also be seen to provide a fairly typical case or context for study; or, at least, of not constituting an atypical or extreme case. The school has historically had conventional IT curriculum arrangements. It has offered subjects from different IT traditions – CPS and TIM. These are the IT subjects that are most commonly offered in New Zealand secondary schools (see Table 12). A trawl through the responses to the national questionnaire sent to all secondary and composite schools shows that the large majority of schools who responded had both CPS or computing and TIM or similar courses amongst their IT subject offerings⁹. Also, participation patterns in the different IT subjects at KHS reflect national trends, whereby males tend to outnumber females in CPS enrolment figures and females to outnumber males in TIM (see Tables 8, 9, 10, 13 and 15). Thus, KHS provides a useful lens through which to explore the phenomenon of students’ experiences of curriculum culture in specialist IT classes, knowing that the curriculum arrangements at KHS are echoed in a number of New Zealand high schools and that these schools are likely to have a similar curriculum culture to

⁹ Of the 198 schools who responded to the questionnaire, 88 schools indicated that they offered both CPS/computing and TIM courses; 146 schools offered CPS/computing, and the majority of those offered other computer related courses as well, such as TIM, IT, ICT, information management and keyboarding.

that at KHS. This is not to assume sameness between schools. A particular high school will have its own unique institutional arrangements and history pertaining to staffing and curriculum developments, which will contribute to a unique curriculum culture in that school. Nonetheless, the typicality of KHS means that it is likely that the characteristics and tensions that are manifest in the curriculum culture at KHS are also present in a number of other New Zealand secondary schools.

Implications

The findings of this study present some dilemmas and issues for policy makers, at national and local school levels, and for classroom teachers.

For national curriculum policy

To date the formal curriculum for specialist IT subjects in New Zealand has been in effect an *ad hoc* curriculum, a cobbling together of subjects from a variety of IT traditions. It has evolved in an ecological fashion. New IT subjects have emerged from older traditions. Responsibility for the development of the detail of the specialist IT curriculum in New Zealand has been devolved to schools; curriculum development has been entrusted to teachers in schools, who choose from and develop courses based on a variety of qualifications and assessment options. At the level of school decision-making it is apparent that the shape given to the curriculum in practice is highly varied, which is revealed in the wide range of courses offered at different schools, even though some subjects are more common than others.

It could be argued that this devolutionary process provides flexibility and allows teachers to cater for the needs and interests of their students, the assumption being that teachers know what students need and want and that they have the skills and knowledge to present this. At the macro level, a preponderance of different subject arrangements in schools could be seen to provide for a variety of students' needs and their desires for different IT options. However, this study suggests that historical circumstances and the computing backgrounds and interests of the teachers are strong influences on the curriculum in practice in an individual school. The

curriculum may reflect teachers' backgrounds and curriculum allegiances more than it does students' needs and interests. Teachers actually help to create student need for particular subjects, because it is teachers who define the courses that are on offer and it is from these courses that students make their selections. In the case of KHS, the historical departmental arrangements and the personal backgrounds and IT interests of the two teachers who manage the CPS and TIM courses have contributed to the maintenance of a conservative curriculum in practice. It can be seen, then, that devolution of responsibility to schools and teachers helps to maintain a conventional curriculum in some school environments. This situation draws into question any assumptions that *ad hoc* or flexible national curriculum structures and the devolution of curriculum responsibilities to teachers in schools will encourage curriculum innovation or a high level of responsiveness to technological developments. The nature of change will depend on the unique circumstances in different institutions. In the New Zealand context, innovation in IT schooling may be as much a matter of chance as it is of design – a matter of fortuity relating to staffing arrangement and the backgrounds and experiences of those who have responsibility for curriculum development and the design of specialist IT courses in particular schools.

Another issue for national policy makers pertains to the persistence of gendered curriculum domains and associated equity concerns. In the 1980s a strong equity concern relating to access to computers was expressed in the international research literature (including, Becker & Sterling, 1987; Chen, 1986) and in the New Zealand literature (for example, McKinnon & Nolan, 1990; Vasil et al., 1987). It was felt that inequalities in access underpinned gender differences in interest and participation in computing. Beynon (1993a), drawing on the work of Willis (1987), observed that girls tended to be excluded from computer facilities in schools, because priority of access was given to computer science classes. There was a “girls’ ghetto”, namely word processing, which was the domain in which girls participated in much higher numbers. Concern was expressed that the curriculum was leading girls to be “IT slaves” and boys to be “the managers” (Beynon, 1993a, p.165). In general, access to and the provision of computers in schools is less of an issue in the new millennium than it was in previous decades. More specifically, it is not a factor that has excluded females from participation in specialist IT courses at KHS. However, it could be argued that a girls’ ghetto exists at KHS in 2001 in the form of the all-female 12TIM class, although it is doubtful that the girls involved would

see this class as a ghetto. An all-female domain exists despite the facts that CPS and TIM courses are available to all students at KHS, that there are designated computer rooms for both CPS and TIM classes, and that both boys and girls in years 10 and 12 attest to being regular users of computers outside of school time, in their own homes or at friends' houses. Thus, gender differences in participation in IT courses at KHS in the new century are not simply matters of access to computers. Explanations for this situation need to be found elsewhere. The work of Dryburgh (2000) and the findings of this study suggest that explanations for gender differences are found in a more subtle combination of institutional and interpersonal factors. Also, this thesis suggests that there are powerful discourses that establish particular computer practices and subjects as masculine and feminine computer domains, which need to be challenged if gender participation patterns are to be broken down.

A dilemma for national policy makers, then, is to determine whether there is an equity issue about which they should be concerned; and then, whether any form of curriculum intervention is appropriate. Options vary depending on whether policy makers wish to emphasise consistency and sameness, or diversity and difference in students' IT schooling experiences; also, depending on which interests are deemed to be paramount – those of the economy, the IT industry, or diverse groups of students. A discussion of detailed policy options is beyond the scope of this thesis. It would involve detailed consideration of theory and models pertaining to curriculum development and change management. However, the findings of this research highlight issues for curriculum policy makers. Fundamental to a policy discussion is an appreciation that the IT curriculum culture in New Zealand is a gendered culture. In some schools, as epitomised by KHS, the curriculum in practice sustains traditionally gendered subject and classroom cultures, although these are of a subtle and evolving nature. What to do about this at a national and structural level, if anything should be done, is open to debate and further research.

For school curriculum policy

It is apparent from my observations at KHS that teachers act as significant agents in the construction of the curriculum, albeit with some teachers being more influential than others in this regard. They are responsible for the form of the curriculum in practice – the subject

content and presentation of that content. Consequently, their beliefs about what specialist IT courses should be about, how they should be organised and presented, and whose interests they should serve, are central to the experiences of students. At the level of school curriculum development, then, questions are raised for teachers relating to the nature of subject choice in the local curriculum. Teachers need to consider both whether providing subject choice is desirable and, if so, what form that choice should take. What subjects should be offered to students? What IT content, computing practices and software applications should be included in these subjects? The decisions the teachers make could have a profound effect on students' ideas about what boys and girls 'do' with computers.

Paradoxically, curriculum developments at KHS that are designed to make computers and specialist computer education more attractive to a range of students have sustained a gendered IT curriculum culture. The adoption of the computer-as-tool construction of CPS and TIM courses has been successful in facilitating the involvement of boys and girls in specialist IT courses. Both male and female students are engaged in CPS and TIM courses; in fact, more females than males are involved in specialist IT courses at year 12. However, these developments have not broken down gender divisions in participation patterns for the different IT courses. It is ironic that the drive to change the face of computing at KHS and the provision of subject options that ostensibly cater for the different interests of students appear to have been highly successful in involving students with computers while at the same time maintaining gender differences. Students are choosing between IT subjects in a way that maintains or even strengthens the association of gender and different computing practices. This may not be so much a matter of choice *per se* as an issue of what types of choices students are being asked to make. At KHS students are required to choose between two subjects that are closely associated with what students (and teachers) think are male and female computer practices. The nature of the choices thereby sustains a gendered curriculum culture.

The teachers at KHS are aware of gender differences in students' subject choices and computing preferences, but they do not question their own roles in creating and sustaining a gendered curriculum culture. The teachers responsible for the CPS and TIM courses do not raise any concerns about the potential of the curriculum arrangements that they have put in

place to reinforce gender stereotypes. They appear to be focused on protecting their traditional curriculum domains and differentiating their curriculum patches. They use perceived differences in students' computer interests and subject choices as justification for this protectionism. Students' needs and interests are considered and addressed – for example, the move to emphasise programming and include new functions such as web authoring in the 12CPS course in response to perceived student need – but not necessarily in a manner that challenges the *status quo* of departmental and subject divisions and of a gendered curriculum culture.

Theoretically, choice can be constructed in a manner that sustains gender stereotypes – witness the gendered curriculum culture at KHS – or in ways that soften or reduce stereotypes. The persistent dilemma is that students, males and females, want different things from specialist IT courses and respond differently to the ways that these courses are organised and presented. The challenge for teachers, then, is to create a specialist IT curriculum at school level that caters for students' different desires, addresses potential inequities and takes into account the complexity of gender relations surrounding the use of computers and curriculum construction. This might mean giving consideration to alternative local curriculum arrangements and different combinations of approaches for IT schooling. Possibilities include: cross-curricula computing, where learning with and about computers is devolved to different curriculum areas; a project oriented approach that is based on design briefs, such as that promoted in the New Zealand Technology curriculum (MOE, 1995); the re-conceptualisation of what constitutes IT literacy, such as the creation of a concept of IT fluency that requires an increasingly sophisticated understanding of technology and the acquisition of this knowledge in authentic IT contexts (AAUW, 2000); the conscious promotion of one paradigm, such as computer science or a computer-as-tool paradigm; or the creation of a new paradigm. The multiplicity of specialist IT subject offerings described in the responses to the national questionnaire to secondary and composite schools (see Table 7) suggests that teachers are actively engaged in curriculum development at the local level and may have countenanced these ideas. However, whether or not they do this in conscious consideration of gender issues is unclear. This research suggests that they should.

For classroom pedagogy

The findings of this thesis have implications for teachers' classroom practice. As well as influencing students' experiences at the structural level of course design, teachers can have a profound influence on students' experiences at a personal level through their pedagogic practices and interpersonal interactions. Being aware of the significance and subtlety of this personal influence is important if teachers are to help create positive learning experiences for students.

For some students in CPS and TIM classes at KHS in 2001, their close relationship and sense of personal identification with their teacher is a significant factor in their IT subject choices. It also contributes to students' positive experiences of CPS and TIM courses. There is a converse effect for a few students, though, where tension is evident in the teacher-student interactions. A recurrent theme in students' talk about their positive and negative experiences in 12CPS and 10TIM classes is the issue of access to teacher time, and in particular to one-on-one teacher assistance. Students express frustration at what they perceive is a lack of ability for teachers to give them the time and personal assistance that they need. By way of illustration, a number of students in 12CPS, including male computer enthusiasts, express disgruntlement at delays in getting assistance from Mr Lucas. Access to and constructive interaction with the teacher is highly valued.

Even though specialist IT courses at KHS are constructed in a way that emphasises independent activity and self-paced work, students engage closely with their peers in the private sphere of the CPS and TIM classrooms. Some students clearly identify more closely with groups of the same gender, sharing IT interests and having a common sense of purpose. Others form mixed-gender peer groups in specialist IT classes. Whatever the gender character of the peer groups, students are observed to work in parallel with their near neighbours and to use their friends as a resource to help them solve problems that they encounter in the learning tasks.

Thus, interpersonal factors are important to students, males and females. Social interactions with teachers and with peers provide a sense of belonging or of being part of a group. They also provide valued learning assistance for individuals. This finding is consistent with the recent New Zealand literature relating to evidence of effective pedagogy. The literature emphasises the importance of social and interpersonal factors in the experiences and success of students, particularly the capacity of teachers to construct positive relationships with students and to create a challenging and supportive learning environment for diverse groups of learners. This research includes a best evidence synthesis (Alton-Lee, 2003) and research on the schooling experiences of Maori and Pacific Island students (Bishop, Merryman, Tiakiwai, & Richardson, 2003; Hill & Hawk, 1998, 2000).

Questions are raised for IT teachers about the possibility and desirability of a change in pedagogy. For example, is the way that IT content has traditionally been organised and presented at KHS really the most appropriate way for different groups of students in CPS and TIM classes? The teacher, it would seem, is a key classroom resource, especially for students such as Kathy in 12CPS and Rawiri in 10TIM, who do not have the knowledge, prior experience and confidence that enables them to trouble-shoot problems as they encounter them. They need input from their teacher and peers. This suggests that the emphasis on independent and self-paced work that is apparent in specialist IT classes at KHS, and in 12CPS in particular, might not be as successful in meeting the needs of individual students as teachers may assume. It appears that a greater mix of classroom instruction and independent work, and structures and systems that provide greater access to and instruction from the teacher, would assist a range of students in CPS and TIM classes, and those like Kathy and Rawiri in particular. It is a matter of balance between teacher directed learning episodes and independent activity.

It is also evident in this study that teachers present mixed and contradictory messages about subjects that can reinforce gender stereotypes. This happens in subtle ways. For example, whilst Mrs Keall's rhetoric about 12TIM is that the course is an improvement on the antecedent typing course, because of the new focus on design and problem-solving, her use of examples from office and business applications and the inclusion of keyboarding drill-and-

practice activities helps to maintain a persistent connection between TIM and office work, and consequently a strong association of TIM with female computing practice. Teachers need to be conscious of the potency of these unintended messages if they wish to change the gendered character of the curriculum in practice. The idea that there are gendered domains of IT practice is set in the examples used and reinforced in spontaneous classroom interactions, albeit unconsciously and with unintended results.

All this suggests that teachers need to pay attention to structural, pedagogical and interpersonal matters if they wish to effect change and break down entrenched attitudes and the persistent stereotyping of computer practices as masculine or feminine activity. Gender-IT relations are complex and constantly subject to negotiation at national and local levels, through curriculum developments, pedagogical practices and social interactions. It is unlikely, then, that there is an easy fix or single solution to the perceived ‘problem’ of gender and computing. To effect widespread change may require policy changes and action at the national level. Which is not to say that changes in curriculum policy and pedagogical initiatives should not be undertaken at a local level in an effort to achieve a reduction in the gender differences and inequities that exist in a society where computer expertise is defined in technological terms and where masculinity is closely associated with technological competence. Also, the findings of this thesis suggest that addressing gender issues is not simply a case of addressing the interests of boys and girls as homogenous gender groups. It is instead a matter of recognising the heterogeneous character of gender and taking a multi-faceted approach to gender-IT issues in order to advance the needs and interests of individuals and different groups of males and females.

One of the things over which teachers have control or influence is the pedagogy of the classroom. By adopting an experiential or reflective approach to their own practice, teachers may become more aware of how they influence students’ experiences of IT courses. Theoretically, they would then be better able to address the structural and interpersonal factors in their classrooms that may encourage individual students to conform to or resist gender stereotypes and to view particular computing practices as being for them or not for them. Teachers could do this by questioning the ways in which they manage social interactions and students’ interactions with computers in the IT classroom, and by considering different ways

of organising teaching materials and learning activities. At the very least, teachers would gain greater awareness of how they contribute to or confound the gender stereotypes that particular IT practices and subjects are masculine and feminine domains.

Afterword

At the conclusion of the research and examination process the teacher participants in this study will be given feedback on the results and the implications of the study findings. They and other interested parties at KHS will be invited to an informal social gathering. At this time they will be given a written summary of the study results and implications, which I will talk to, and they will have an opportunity to ask questions and engage in discussion about the findings. A copy of the thesis will be made available to them.

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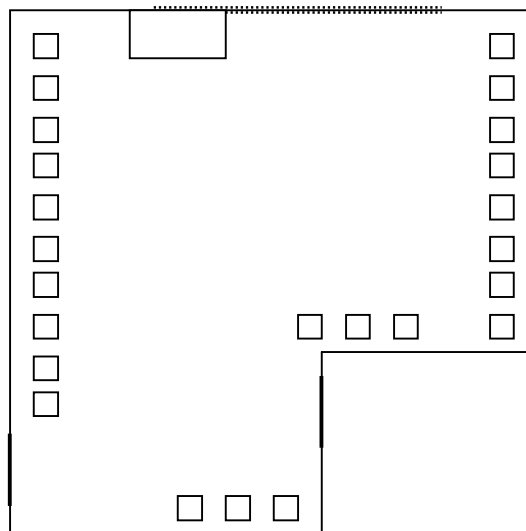
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Appendix A Questionnaire

Appendix B Example of an observation record

Observation Record

Class: 12CPS
 Date: 4/9/01
 Student: Scott (M1)
 Teacher: Mr Lucas
 Period: 4
 No. of males: 9
 No. of females: 5
 Topic: Programming
 Software: Chipmunk Basic
 Comment:



Codes:

R researcher/observer
 T teacher
 v video
 sm student microphone
 tm teacher microphone
 ss students
 M1 male student no.1
 F3 female student no. 3

Time	sm	tm	Student conversation (M1=Scott)	Action/behaviour	Observer comment
11.45					R setting up microphones
	000		R: You're going to be quiet aren't you, coz I can hear what you're going say. M1: Mmhmm ...	M1 enters room – into program M1 initially pretends he isn't going to talk – jesting with R	
	005		R: So Scott, what are you doing? M1: Mucking around. R: Doing? F1: He always (mucks) around. M1: --- (works) R: A program, designed to do what? M1: Oh, yeah. No wonder it's not running. No disk. [chuckles] ... [social conversation with F1]		
	O31		M1: (Do you want) an awesome game? R: So tell me, how does it	M1 pulls up program he has written – Russian Roulette; with obscene language in the	M1 is playing with the program he has created; may be demonstrating this for R –

Time	sm	tm	Student conversation (M1=Scott)	Action/behaviour	Observer comment
12.00	047		work. M1: --- like click_click_ R: Oh, nice sentiment, Scott M1: You know that Russian game when you put one bullet in a chamber and you spin it. R: Russian Roulette. ...	script eg. "Fuck you're dead" when shot; "chicken shit" when quit M1 explains that the language is a boy thing. You can't have flowery language for a boys' game.	proud of his effort and wanting to show off and/or shock.
			R: That's a different one. [commenting on different program, which Scott has just opened] M1: Yeah, --- [silence]	M1 brings up second program he has written – interactive; invites player to type in and odd number – get a pattern on the screen. M1 into/focused on current program he is writing (racing car game) Trial and error Pulls up help menu M1 watches what F1 is doing, then goes back to his own work (creating racing car game) M1 closes program/quits? (or new window?)	In background F3 (Lisa) calls Mason over. "Mason, can you help me for a moment"
	115		T: And the same with this one. M1: Yeah, yeah [stutters] you told me --- the things are in (there) T: Yeah, and we should have had a return there_ [sound of paper turning] Same in that one_ Same thing... You should have just got KM in there_ Did it actually come up with an answer? [silence]	T returns work to M1	
		124	R: What was the problem there? M1: Eh? ...	Error message – quits? (or new window)	
	151		M1: I've discovered (a) easy way of getting it going now. Just type ---. ...	M1 runs the program – gets message "extra information in line 120" Returns to program – adjusts Runs again Same message – adjusts (deletes information in line 120) Runs Gives command to list line 120 (so that he doesn't have to scroll up to line 120 – saving time) Runs Gets message "syntax error" in line 260 Lists line 260 Adjusts code in line 260	
	160		F1: Oh!_ Scott how do you get rid of some that you don't want? M1: What one do you (not)	M1 looks over, watching F1's screen and advising	

Time	sm	tm	Student conversation (M1=Scott)	Action/behaviour	Observer comment
12.17	199		<p>want? F1: I don't know. Hold on. [chuckles]_ Oh no, it's gone. How do you do the P? M1: Eh? F1: How do you draw the P? M1: How did you draw the C? ...</p> <p>F1: Scott, how do you get back up <i>there</i>, without (that line)? [F1, M1 and F2 chuckle]_ But it probably won't work. Shut up. Oh. Shut up! OK, graphics_ (Scott), no. Line two_ ... M1: But it has to do two. (Coz) you just corrected one, didn't you? F1: No. I just, I accidentally half way through it did <i>that</i>, and then ohhh! [frustration] M1: Yeah, what it is, is it's correcting itself. It's showing you one what you did before and one what you have done now. ... [silence]</p>	<p>M1 back to work</p> <p>R2 asks T for help F1 asks F2 to explain what T said</p> <p>M1 closes window – opens new window (because program wouldn't work)</p> <p>M1 uses trial and error to try and solve problem “RUN” Gets message that there is bad subscript in line 120 Puzzled by message M1 looks around to see what T is doing (wants help)</p> <p>F1 typing – getting help from F2 and M1; giggles at her foolishness</p> <p>M1 back to own program trial and error Runs program (twice) Gets syntax error</p> <p>M1 smiles at F1 – reacting to what she is doing</p> <p>M1 back to his own program Error message “Syntax error, missing variable in line 120” List 120 Adjusts code in line 120 Run Error message “Bad subscript in line 120” List 120 M1 repeats the process 7+ times – keeps getting the error message Adjustments made include Deleting code script Deleting quotation marks around portion of code</p>	<p>M1 repeating “List” command to simplify the procedure – stop need to scroll (as learned earlier)</p>

Time	sm	tm	Student conversation (M1=Scott)	Action/behaviour	Observer comment
12.28	283		M1: What's (the tape) --- R: --- (counter) ---. ... R: --- syntax, which is the, it's like the grammar of it. M1: [muttering to self; computer beeps] --- Or that_ Ohh!	Adding bits of code M1 is puzzled – stops typing – looks around for T (sees T is with Kathy) M1 watches what F1 is doing M1 asks R about the tape (saw R look at the counter) R and M1 briefly discuss error messages M1 picks up on grammar idea (from R's comments) changes a : to a ; in the code Runs Gets error message (re extra information) M1 sitting, waiting. M1 goes back to code Changes code – i to 1 Runs Gets error message M1 talking to himself/aside M1 looking around, waiting, looks round at T (doesn't put hand up or call out name) M1 goes back to code – tries again – no success M1 looks around for T – pause from activity as he looks around F1 and F2 conversing; F1 telling F2 what to type; F1 succeeds in drawing C P on screen - F1 and F2 working together; F1 copies script dictated by F2 M1 back to work – tries different command "Data" command inputted Still puzzled at result Goes to line 120 and uses "help" option Gets response NEXT without FOR in line 120 Goes to code and adjusts	M1 is a one-finger typist F4: So what do I do down here? Conversation in background (transcriber counter 257)
	310		M1: God knows what I'm doing wrong.		
	359		M1: Ooh, (nailed it down). R: Pardon? M1: Nailed it down. --- ...		
	375		M1: [popping sound] Finally got it. Its_ R: What was it? M1: I just put a, didn't put a REM in it. R: Oh, OK. M1: A REM statement_ I didn't put, didn't add it in to it.		M1 keen to explain what he is doing; sense of satisfaction he has solve it – wants to show R what it was/the code that he mastered

Time	sm	tm	Student conversation (M1=Scott)	Action/behaviour	Observer comment
12.37	388		... M1: Ohhhh! [groans]_ Ohh! It's not going to stop._ ...	M1 runs – gets another error – computer won't stop scrolling info up on the screen – just keeps going	Social interaction
	405		R: Did you just quit it? M1: Yeah, I couldn't get out of it!	M1 trying all sorts of options to make computer stop Quits without saving – Cancel Drags scroll bar up page Quits (couldn't stop action)	
	437		M1: What did she pick on you for? F1: Who?	M1 back into program Back in trial and error mode Puzzled, pauses	
				M1 nods in direction of students (Joanna? Bridget?)	
				M1 looks at what T is doing, but doesn't ask for help – pauses M1 back to trial and error Into help (for information on commands)	
			[Bell]	T helping F1 T helping F2	
				M1 quits without saving – ejects disk	
				M1 over near printer	
			(M4: I couldn't get that game to...)	M1 interacts with M4 (Mason) re. games. They leave the room together, talking about a game.	

Journal Notes

- In conversation with T after the lesson he indicated that he has a problem trying to get Scott to “do it properly” (programming). Scott doesn't use an appropriate structure – not logical – so T can't understand what he has done; Scott's programming is from trial and error and lacks logic – is “hit and miss”; T thinks Scott has limited employment prospects because he isn't necessarily logical – doesn't follow the formula/structure for programming expected by T
- T also observes in conversation before the lesson that it looks like they will adjust the CPS course to accommodate the overlap with TIM; comments that TIM “dabbles” in all the things (applications) that are done in CPS
- “Dabbles” is an interesting choice of word – implies CPS more serious and in-depth than TIM
- In conversation with Scott before the lesson he indicated that he isn't working on the sheet – is working on his own programs; is doing something extra that has been set by T
- It is interesting how many enlightening comments come after or before class, when the microphone is off
- During the observation lesson Scott was trying to fix his car game program.
- Scott doesn't always understand what comes up in the messages e.g. syntax error – didn't connect this with grammar. In lesson he responded to information given by R by changing : to ; (didn't solve the problem though!)
- Lots of trial and error observed in lesson – keeps trying/perseveres to solve problems – tries 7, 8, 9 times before looking for a different strategy
- Uses help option when stuck
- Simplifies procedure by just listing the line with a problem (learnt from trial and error)

- Doesn't ask T for help at all (although he looks around to see where T is – impression he would seek help if T is close); paused when frustrated and looked to see what F1 and T were doing but never asked for help.
- Seemed to enjoy interacting with R to explain what he was doing – makes him feel special?; very helpful if asked something by F1 (but sees his own ability as superior?)
- Scott played two programs he had created early on – Russian Roulette and Patterns - this could have been for R's benefit (to impress); spent most of lesson working on a car game
- Sense of competition with the machine – mastery is important to him
- At one stage Lisa asks Mason for help (Mason as the expert/consultant)
- Identifies what he is doing with computers as a “boy thing” – the games – can't possibly have flowery stuff in a boys' game (for boys, created by a boy) – swearing is a boy thing/violence is a boy thing?
- Scott is: a hacker, a trier, someone who perseveres, challenged and motivated (by programming), “in his element” (T's comment), proud of his ability, conscious/self-conscious (subtly seeks recognition and acknowledgement of his skill)

Extra:

- In miscellaneous comments somewhere T comments that Scott is able to do things he (T) could never do, but that there is a problem with his illogical approach
- See journal record for 31/8/01; before the microphone is turned on in this lesson, Scott states in conversation that boys understand computers and that girls don't; also, that boys talk and that girls don't; he perceives a gender difference in ability and behaviour

Appendix C Transcript notation

Ab:	code for speaker's name
Ab?:	The speaker is thought to be Ab, but this is uncertain
F?:	unidentified female speaker
M?:	unidentified male speaker
[note]	observation or explanation added; not part of the taped conversation
(text)	best guess at a word or phrase
text ---	signifies an inaudible word or phrase
text_	signifies a pause; thinking time
text... continues	signifies that a section of transcribed text has been omitted
– text –	explanatory phrase that is part of the transcribed conversation
<i>emphasis</i>	stress or emphasis on a particular word or phrase by the speaker

Appendix D Interview questions for teachers

Guiding questions for semi-structured interviews with teachers at the beginning of the observation sequence

General

1. Tell me about this class?

Class organisation

2. Is the hardware organised in a special way? How? Why?
3. Are students organised in a particular way? How? Why?
4. Is there a seating plan? Is this likely to remain the same throughout my observations?

Teacher background

5. What is your background in computing and computer teaching? Training? Professional development?
6. How long have you taught CPS/TIM? Why this subject?

Learning focus

7. What topic/unit is being taught?
8. How does this fit into the scheme for the year?
9. What are the aims of this unit?
10. How does this course differ from similar courses at other levels and managed in other departments?
11. How would you describe the teaching approach taken with this unit?
12. What is the knowledge and skills background of the students as they begin this unit?
13. What are the students learning about computers?
14. What aspects of this topic/course do you think students respond to most/least positively?
15. What do you think the future holds for the students in this class e.g. employment, education?

Class dynamics

16. How would you describe the dynamics of this group of students? The social environment? The learning environment?
17. Who do you think are the student leaders? Why?
18. From whom do the students seek help? Why?
19. Who sits with whom? Why?
20. Who seems to be most knowledgeable or skilled with computers? Why?
21. Do you think there are any differences between the attitudes to computers of boys and girls in the class? Attitudes to this particular class? Attitude or reaction to this particular topic? Application to work? Ability? Prospects?

Other

22. What are the computer arrangements in the school e.g. number of computer rooms, clusters, laptops for students? What are the plans for the next few years?
23. How are the courses and classes organised? Are the junior classes compulsory or optional? How many periods per week? For how many weeks in the year?

Appendix E Interview questions for students

Guiding questions for semi-structured interviews with students

Attitudes to computers

1. Do you like working with computers? Why/Why not?
2. Do you think you are good with computers? Why do you say this? What has happened that makes you think you are/are not good with computers? Are there any particular incidents that have occurred that make you think this?
3. What topics/applications do you like the best? Why/why not?
4. What topics/applications do you think are the most useful or helpful? Why/why not?
5. What sort of learning tasks or activities do you like the most? Why is this? Describe these activities in detail.
6. What sort of learning activities using computers do you think are the best for you? Why? (What are the most helpful or useful?)
7. Describe for me a) something positive, b) something negative that has happened to you in this class. How did this affect you?

Choices

8. Why did you choose to take this particular class? If you were making your subject choices again, would you still choose to take this class? Why/Why not?
9. Do you like this a) subject b) class? Why/Why not?
10. Will you take this subject next year? Why/why not?
11. (Yr 12 classes only) Would having an NCEA qualification for CPS and/or TIM encourage you to take CPS or TIM in year 13? Why/Why not?

Computer use

12. If you have a problem with the computer, or don't know how to do something, how do you solve the problem? Who do you go to for help? Why?
13. Do you use computers outside of class time? Where? When? How frequently? What do you usually do with computers at this time? Why do you use/not use computers much outside of class?
14. Have you taken other computer classes before this? What? When?

Skills and knowledge

(NB: These two questions were added during the interview sequence in response to comments by girls in 12TIM that they didn't know how computers worked and their emphasis on typing skills in comments pertaining to other questions)

15. Are you a 10-finger typist? Why/why not?
16. Do you understand how a computer works (file management, operating system)? Why/why not?

Teaching approach

17. How would you describe your teacher's style or approach to teaching computing/IT skills? Do you like this approach? Why/Why not? Do you think this approach is effective in helping you learn about computers? Are there any particular incidents that have occurred that make you to think this?
18. What do you think the teacher expects of you? What skills get rewarded?
19. Do you have any input into what you do in the classroom? Explain.

Aspirations

20. What would you like to do for an occupation when you leave school? What sort of job do you think you will get?
21. Do you think you will end up using computers in your job? What do you think are the most important computer skills you will need in this job? Are you likely to have these skills? Why/Why not?

Perspectives on gender

22. Some people think that computer classes are unfriendly or less enjoyable for girls than boys. Do you think this is true? What makes you say this? What experiences have you had that lead you to think this?
23. Some people think boys are better at using computers than girls. Do you think this is true? What experiences have you had that make you think this?
24. (*Co-educational classes only*) Do you think boys and girls are treated differently in this class? Why/why not? What leads you to say that?
25. (*Co-educational classes only*) How do you think the boys and girls get on in this class? Is this the same in all classes or particularly the case in this class? Why do you think this is so?
26. (*Single-sex classes only*) If there were boys/girls in this class, do you think the atmosphere would be different? Do you think it would be better to have boys/girls in your class? Why/Why not?

Impact of observation

27. You have had a microphone placed near you at some stage when I was observing your class. Did this affect what you did or how you behaved? How?
28. How would you have behaved differently, or used the computer differently, if I wasn't there?

Appendix F Ethical approval and consent forms

Information Sheet for School Principal

**University of Canterbury
Department of Education**

INFORMATION

Teachers and students at Kahikatea High School are invited to participate as subjects in the research project

Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms.

The aim of this project is to describe how gender relations inform and shape the experienced curriculum in specialist IT courses.

Involvement in the project will include

- a) participation of selected teachers and HODs in interviews to describe how IT courses are organised at Kahikatea High School and why decisions have been made to structure the IT curriculum in a particular way
- b) participation of three or four specialist IT teachers in interviews to describe the aims of their particular courses, their teaching approaches and what they think are the experiences of IT of the students in their classrooms
- c) participation of the three or four specialist IT teachers and their classes as subjects of intermittent classroom observation over the course of a year (over 2 terms for each class)
- d) participation of approximately six selected students from each of the classes in interviews to describe their experiences in their information technology class.

The interviews will be audio taped. A copy of the interview transcript will be made available to the participants and they will be given an opportunity to comment on the written record. As part of the classroom observation procedures audio and video recorders will be used. The classroom teachers will be given an opportunity to view any audio and videotapes taken in their class, on request.

As a follow-up to this investigation, the subjects may be asked to participate in subsequent interviews or discussions to clarify points with the researcher.

In the performance of the tasks and application of the procedures there are no anticipated risks to the physical or cultural safety of teachers or students. They may decline to participate in the research or withdraw from the

research at any time, including withdrawal of any information they have provided. Teachers may also decline the use of any of the recording equipment in classroom observations.

The results of the project will be presented in a Ph.D. thesis and may be published, but you may be assured of the complete confidentiality of data gathered in this investigation. The identity of participants (teacher and students) will not be made public without their consent. To ensure anonymity and confidentiality codes will be used to identify the schools, teachers, classes and students on interview transcripts and other data records. No real names will be used in the reporting of the research findings.

The project is being carried out by Jane Abbiss, who can be contacted at [phone number]. She will be pleased to discuss any concerns you may have about participation in the project.

The project has been reviewed by the University of Canterbury Human Ethics Committee.

Research Consent Form for School Principal

Project Title

Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms.

Principal

I have read and understand the description of the above named project and consent to the participation in the project of the selected teachers and classes at Kahikatea High School.

Signed: _____ Date: _____

Information Sheet for IT Class Teachers

University of Canterbury
Department of Education

INFORMATION

Project Title: *Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms*

The aim of this project is to describe how gender relations inform and shape the experienced curriculum in specialist IT courses.

Your involvement in the project will include

- a) participation of yourself and your class as subjects of intermittent classroom observation over the course of two terms
- b) participation in an interview to describe how IT courses are organised in your school, the focus and aims of your particular course, your teaching approach, the character and social dynamics of your class and students' experiences of IT in classroom.

The interview will be audio taped. A copy of the interview transcript will be made available to you and you will be given an opportunity to comment on the written record. As part of the classroom observation procedures two tape recorders and a video camera will be set up in the room. You will be asked to wear a small recorder and lapel microphone. You will be able to listen to any audio recordings and view any videotapes, on request.

As a follow-up to this investigation, you may be asked to participate in subsequent interviews or discussions to clarify points with the researcher.

In the performance of the tasks and application of the procedures there are no anticipated risks to your physical or cultural safety. You may decline to participate in the research or withdraw from the research at any time, including withdrawal of any information you have provided. You may also decline the use of any of the recording equipment in the classroom.

The results of the project will be presented in a Ph.D. thesis and may be published, but you may be assured of the complete confidentiality of data gathered in this investigation. The identity of participants (teacher and students) will not be made public without their consent. To ensure anonymity and confidentiality codes will be used to

identify the schools, teachers and classes on interview transcripts and other data records. No real names will be used in the reporting of the research findings.

The project is being carried out by Jane Abbiss, who can be contacted at [phone number]. She will be pleased to discuss any concerns you may have about participation in the project.

The project has been reviewed by the University of Canterbury Human Ethics Committee.

Research Consent Form for IT Class Teachers

Project Title

Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms

IT Class Teacher

I have read and understand the description of the above named project. On this basis I agree to participate as a subject in the project and give permission for a series of in-class observations to be conducted in my class _____. I consent to publication of the results of the project with the understanding that anonymity will be preserved. I understand also that I may at any time withdraw from the project, including withdrawal of any information I have provided or that has been collected as part of the in-class observation procedures.

Signed: _____

Date: _____

Information Sheet for Students and Parents

Department of Education, University of Canterbury

INFORMATION

Dear

You are invited to participate as a subject in the research project

Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms.

The aim of this project is to describe how gender relations inform and shape the experienced curriculum in specialist IT courses.

Your involvement in the project will entail participation in an interview to describe your experiences in the information technology class, _____. The interview will be audio taped. A copy of the interview transcript will be made available to you and you will be given an opportunity to comment on the written record.

As a follow-up to this investigation, you may be asked to participate in subsequent interviews to elaborate on points with the researcher.

In the performance of the tasks and application of the procedures there are no anticipated risks to your physical or cultural safety. You may decline to participate in the research or withdraw from the research at any time, including withdrawal of any information you have provided.

The results of the project will be presented in a Ph.D. thesis and may be published, but you may be assured of the complete confidentiality of data gathered in this investigation. The identity of participants will not be made public without their consent. To ensure anonymity, codes will be used to identify the school, class and interviewee on interview transcripts and other data records. No real names will be used in the reporting of the research findings.

The project is being carried out by Jane Abbiss, who can be contacted at [phone number]. She will be pleased to discuss any concerns you may have about participation in the project.

The project has been reviewed by the University of Canterbury Human Ethics Committee.

Consent Form for Students and Caregivers/Parents

Project Title

Gender Relations and IT Education: The experienced curriculum in specialist secondary IT classrooms.

Student

I have read and understand the description of the above named project. On this basis I agree to participate as a subject in the project, and I consent to publication of the results of the project with the understanding that anonymity will be preserved. I understand also that I may at any time withdraw from the project, including withdrawal of any information I have provided.

Signed: _____

Date: _____

Caregiver/Parent

I have read and understand the description of the above named project and consent to the participation in the project of the student in my care, _____
[student's name].

Signed: _____

Date: _____

Letter for all students in the 10TIM, 12TIM and 12CPS classes

[date]

Dear Year [10/12] Student,

I am a lecturer at Christchurch College of Education and a Ph.D. student in education at Canterbury University. I am interested in what happens in specialist IT and computing classes, what students learn about computing and whether there are similarities or differences in the experiences of boys and girls.

I will be collecting research data in your class over the next month or so. You will see me sitting at the back of the room, filling in an observation sheet. There will also be audio and video tape recording equipment in the room. I hope that this will not get in your way and that your class can continue as normal.

Please be assured that your confidentiality will be maintained. I will be taping conversations and activity in the classroom but will not use any students' real names in the reporting of data. If you are unhappy about being part of this research please let me know and I won't quote you in any reported conversations.

Later on I will be inviting a group of students to participate in an interview. Those people will be asked to give personal consent and an information sheet and consent form will be given to them and their parents at the time. You can refuse to be involved in the interviews and are able to withdraw your participation as a subject in the research at any time.

I'm looking forward to the opportunity to be in your class.

Yours sincerely

Jane Abbiss